THE SPACE RACE

A DAILY MIRROR BOOK 2/6

THE SPACE RACE

By RONALD BEDFORD

Daily Mirror Science Correspondent

NO ONE KNOWS when the first human being raised his eyes from the ground and gazed in wonder at the burning stars.

But throughout recorded history, man has had an insatiable thirst for knowledge of the Universe.

His curiosity—about the Moon, the planets, and stars, why they strode in stately procession across the velvet night sky, and of what they were made—sparked off a quest for truth that brought out the best in the human race.

The greatest minds of all nations have, down the ages, bent their energies to the solution of these riddles. They have shared freely the knowledge gained.

But no matter how he tried to add to his storehouse of knowledge of the Universe, man was always balked by one seemingly insuperable problem : he was tied to the Earth.

His inventiveness helped him overcome some of his shortcomings.

The telescope enabled him to get a closer look at the stars.

The camera enabled him to photograph them.

The balloon, then the aeroplane, enabled him to climb, in a puny sort of way, a few of the rungs of the invisible ladder leading to the top of the atmosphere.

But it was not until 1961 that man took the first tottering steps along the way that leads to the stars.

As has happened so often before, it was his destructive genius that paved the way.

The two most terrifying inventions of World War II were the atomic bomb and the liquid-fuelled rocket.

IT WAS THE ROCKET, harnessed for a peaceful task, that enabled man to snap the invisible thread that had kept him, since life began, close to the Earth.

IT IS THE ATOMIC BOMB, harnessed for peaceful purposes in the form of the nuclear rocket engine, that alone can enable him to voyage far beyond the Moon—first to the planets, then to the stars.

The Space Race itself began in July 1955.

Then, President Eisenhower approved a plan, drawn up by United States scientists, to put a series of artificial satellites into orbit round the Earth.

The Soviet Union quickly followed suit. They, too, they revealed, intended to establish man-made "moon" in orbit round the Earth.

Both sides set the Autumn of 1957 as the target for success.

But the Russians won the race.

The shrill bleep-bleep-bleep of their first artificial satellite, blasted away from the Earth on October 4th, 1957, proved to be the birth-cry of the Space Age.

And a new word—Sputnik—was added to everyday language.

One after the other, the Russians and the Americans hurled satellites into orbit. Each was bigger, or carried more sophisticated electronic instruments, than the last.

Some carried passengers—dogs, mice, rats, monkeys.

All were paving the way for the greatest moment of all—the time when A MAN stepped into the passenger cabin and journeyed into space.

The world had not long to wait for this to happen.

The Space Age was only 3½ years old when, on April 12th, 1961, an official Soviet announcement told the dramatic story in the simplest terms.

The historic announcement said :

" A great event has occurred. Man has made a space-flight for the first time in history. An orbital space-ship, Vostok, with a man on board, took off at 9.07 a.m., Moscow time, flew round the globe, and returned safely to the sacred soil of our country."

The man who made the historic journey was Yuri Gagarin.

When the picture opposite was taken, only a handful of people knew his name.

Within minutes of blast-off, it was a name on the lips of the peoples of every race.

And it is a name that will be remembered for as long as there are men who can read and understand.

GAGARIN—safely down

THE HAPPIEST FELLA !

His name is Gagarin—pronounced Ga-ga-RIN, with the accent on the last syllable.

No wonder he looks pleased. For he has just stepped back on to solid ground after circling the world once, in 89 minutes. From blast-off to touch-down took 108 minutes.

He became the first man to go into space and to come back to tell the tale.

HE WENT from a firing-pad at the Soviet cosmodrome—their term for the man-into-space launching base—at Baykonur. This is a small town in the middle of the central desert of Kazakhstan, one of the loneliest and least populated areas of the Soviet Union.

HE RETURNED to Earth in a field near the village of Smelovka, about 400 miles south-east of Moscow. Farm workers rushed to greet him as he stepped from his space-ship. They helped him out of his sky-blue space-suit.

Major Gagarin's historic trip took him 187½ miles from the Earth at the farthest point. His speed : 18,000 m.p.h.

During the trip, he kept a log, operated a telegraph key, and reported back to ground over his two-way radio.

He has a clear, direct, unassuming way of expressing himself. Although he was the first man to look down on the globe and its 3,000,000,000 inhabitants, he kept his messages crisp and short.

He said : " The sky is very, very dark, and the Earth is a light blue. Everything can be seen very clearly. The flight is continuing O.K. I feel well."

THE FIRST MAN

HE LOOKS MORE like a top sportsman (which he is) than the first man in history to hurdle the space-barrier.

His name is Yuri Alexeyevich Gagarin. Born March 9th, 1934.

His eyes are blue. He is short and stocky. He walks with a slight roll. He has a smile that won the hearts of countless millions who could not care less about space research.

They loved him because he looks (and is) just like the nice lad next door, or across the street.

A decent, hard-working young man who had greatness thrust on him. Who managed to cope with the fuss, the speeches, and the medals, and still remain like the boy from next door.

Life was tough, in the early days, for the man who braved the unknown, strapped to a spaceman's foam-rubber couch.

His father was a carpenter. The boy had just started school when Hitler's tanks rumbled into his village. There was time then to learn well only one lesson. That of survival.

What Yuri learned stood him in good stead when he tackled the toughest survival course ever, out there in the grim yonder 187 miles above the Earth, far from the comforting feel of solid ground.

When the war ended, Yuri took up his schooling again. The learning-gap would have crippled many, but not young Yuri.

He went to a craft school, graduating, at 17, with a foundryman's certificate. Then he went to an industrial academy at Saratov, on the Volga. Saratov had an aero club. Yuri joined it. His eyes were now firmly fixed on the stars.

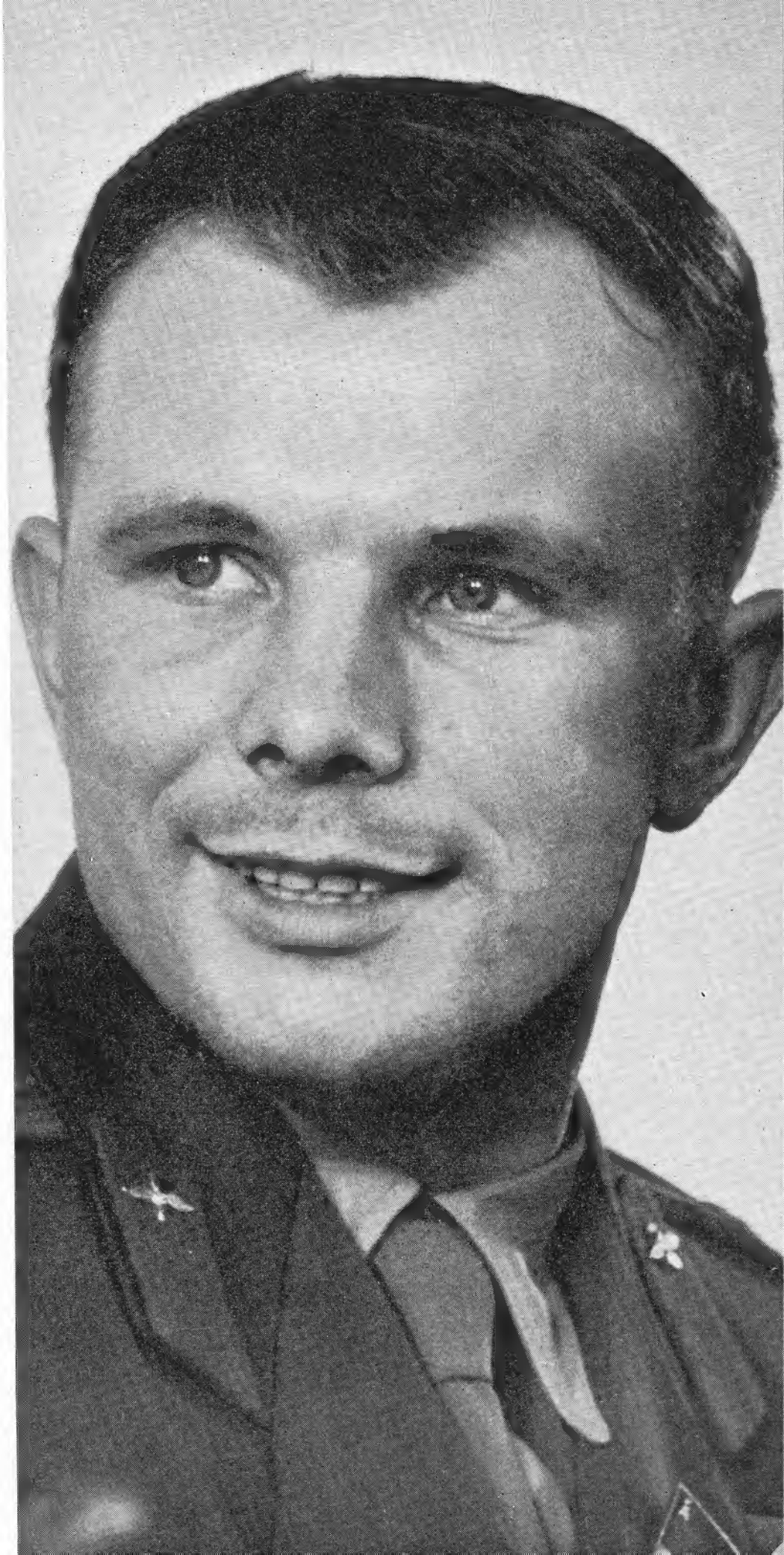
From the aero club, he went to a Soviet Air Force School. In 1957, when the Space Age was born, Yuri Gagarin became a Soviet test pilot.

His brother Boris says: "Ever since he was a small boy, Yuri dreamed of being a flier. We got information about aviation and airmen only from books. Yuri always seemed able to find these books."

During his time as a test-pilot, Yuri volunteered for the space research project.

The space-course was tough—but he had faced tough situations before. He was put through the most thorough series of mental and physical tests that could be devised.

And he came out on top—on top of the world.



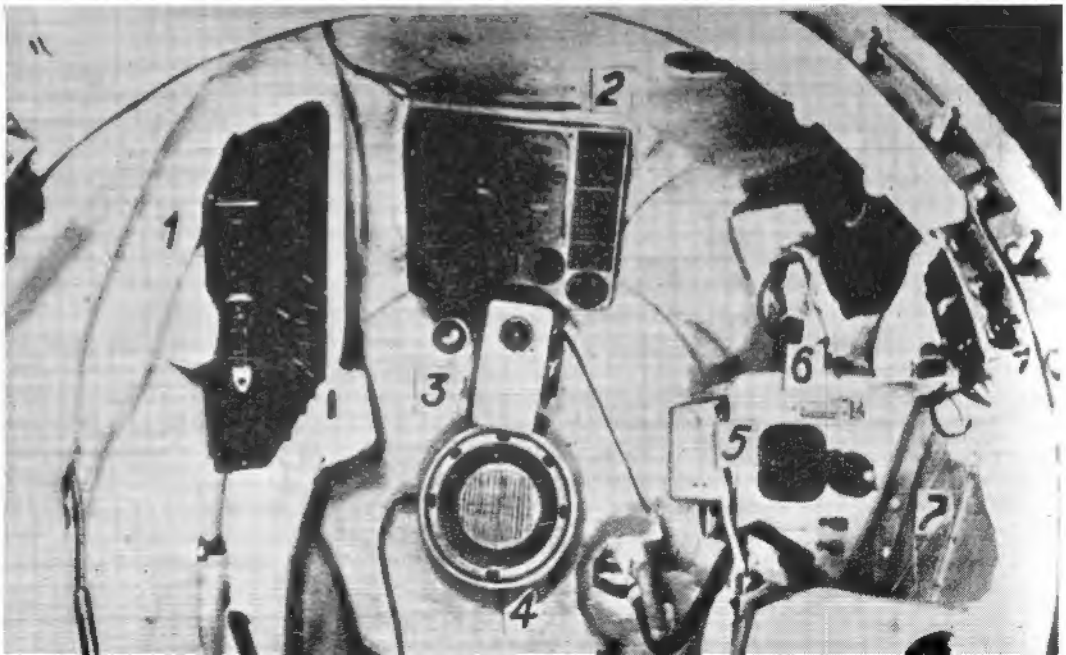
THE SPACE-SHIP

THIS IS VOSTOK, the first Soviet manned space-ship. The name means " East."

The ship weighs nearly 4¾ tons, and carries food and air supplies sufficient for a ten-day space-trip.

The cockpit (seen on right) looks bare, but contains all that is needed to enable the pilot to keep in touch with the control-station on Earth, as well as to see where he is in space. The instruments shown :

1. The control panel.
2. The instrument board. It has a globe seen at the top left.
3. The television camera. This enabled doctors and scientists on the ground to see how the spaceman stood up to the trip.
4. The porthole. It was through this that Major Gagarin became the first man to look down on the Earth.
5. Manual control levers.
6. The wireless set.
7. Food containers.



The beard that grew in Space

GETTING THEIR FIRST man into space, and bringing him back alive, earned the Russians the admiration of the whole world.

But could they do it again ? And keep their second man in orbit for longer than the 89 minutes Gagarin stayed there ?

The world, which asked these questions, did not have long to wait for the answers.

On August 6th, 1961, less than seventeen weeks after Major Gagarin's historic ride, another giant rocket screamed away from the firing-pad at Baykonur Cosmodrome.

Another thick-set young man, with almost a carbon-copy of Major Gagarin's infectious grin, was blasted into 18,000-m.p.h. orbit round the world.

He was one of Gagarin's best friends—26-year-old Major Gherman Stepanovich Titov. He is seen here, immediately after landing from his space-ship, phoning Soviet Premier Nikita Krushchev.

And he spent a whole day—slightly more, in fact, 25 hours 18 minutes—blazing the space-trail. Between blast-off and touch-down, Major Titov grew the makings of a beard, the first to sprout in space.

In addition, he :

ATE a three-course lunch of tasty, highly nutritious concentrated food, which he squeezed out of toothpaste tubes, and followed this with a three-course tube dinner containing different foods ;

OVERSLEPT by half an hour the eight-hour sleep ration that Soviet space-doctors reckoned he would need ;

BROADCAST goodwill messages to the peoples of the continents, including Europe, Asia, Africa and Australia—over which he passed.

Radio stations in many countries picked up these messages from Cosmonaut Titov, whose code-name was Eagle.

"I am Eagle, I am Eagle," he kept calling. His radio messages added that he was feeling fine, and that his space-trip was going well.

NO WET FEET FOR THE FIRST AMERICAN

THE AMERICANS KNEW that they were lagging behind the Russians in the great space race.

They had launched many more satellites than their Soviet rivals, but the spectacular successes—the space firsts—had all been chalked up by the Russians.

When the Spring of 1961 came in, United States spacemen hoped that, with luck, they might win a consolation prize.

The first man into space, they felt, might be an American, not a Russian.

They planned their man-into-space programme in three stages.

First, to send men on brief up-and-down trips, or sub-orbital flights, that would take them 115 miles into space.

Second, to send a dummy man, then a chimpanzee, on a one-orbit mission.

Third, a three-orbit trip by man.

The Phase Three target was the end of 1961, but United States scientists hoped to get a man on a sub-orbital space-trip in early Spring.

And this, they reckoned, would give them an edge on Moscow.

They were readying the 83-ft., 30-ton Redstone rocket at Cape Canaveral, Florida, for a late April manned space-shot when the Russians struck—and sent Major Gagarin into orbit.

Their space-lead was such that Soviet scientists could cut out the need for a sub-orbital manned flight. They had sent dogs into orbit and brought them back alive.

But worse was to follow. Defeat by the Russians was bad enough ; defeat by the weather was worse. A space-shot scheduled for May 2nd had to be postponed because of the weather.

It was re-scheduled for May 5th, but there were more heart-stopping moments before Commander Alan B. Shepard, 37, the first United States astronaut, got his space baptism.

Another bad weather setback, then the failure of an electrical part, held up the manned space-launch. Finally, at 9.34 a.m. as loudspeakers blared out the dying seconds of the countdown, the months of toil and tears came to an end.

Women wept and men cheered as Commander Shepard and his rocket rose on a smooth ball of golden fire, shot through the cloud haze, and disappeared into the blue, leaving only a white zigzag streak to mark its departure.

Inside his Freedom Seven space-ship, Shepard—wearing a silver space-suit—was strapped down on a foam-rubber couch that was tailored to his body.

The picture of him, on the right, was taken about an hour before the blast-off button was pressed.

Down on the Cape, Commander Shepard's quiet voice droned over the two-way radio. He might have been describing a vicarage tea-party. There was no note of tension in his voice, as he added a new phrase to everyday American conversation.

" Everything A-OK "—short for absolutely perfect—he radioed. " On the periscope now. What a beautiful sight."

Commander Shepard's space-trip lasted 15 minutes. It took him 115 miles high. He came down, his space-ship dangling from a big red-and-white-striped parachute, into the sea 302 miles from the Cape.

Commander Shephard's first comment on his space-trip was crisp and to the point. " Boy, what a ride," he said.

The crew of the aircraft carrier Lake Champlain yelled their heads off when Shepard and his space-ship touched down on the flight-deck.

They cheered even more when the man who went to space and came back without even getting his feet wet, suddenly turned his back on the row of top-rankers waiting to greet him.

He ducked inside his space-ship, rummaged around, and came out again clutching his space-helmet, which he had left behind.

Shepard's top speed was only 4,500 m.p.h. against Soviet Major Gagarin's orbital speed of 18,000 m.p.h.

In comparison with the Soviet achievement, his was Third Division space stuff.

But it put new heart into the American people, and into all who admired the way they had carried out their space-shot under the critical eyes of the world's Press, radio and TV men.

Exactly eleven weeks later, Captain Virgil Grissom, 35, a Captain in the United States Air Force, took an almost similar trip.

The AMERICAN Space-Ship

THE TWO MANNED space-shots carried out by the United States so far have been more than a try-out for the astronauts.

The tests were also designed to prove the worth of the Mercury capsule, or space-ship, that United States scientists regard as the best bet for a space-ride.

By Soviet standards, the American space-ship is small. It weighs less than two tons, against nearly 4¾ tons. The reason for this is that, as yet, United States spacemen have not at their disposal booster rockets of such might as those used by the Soviets.

But the American space-ships have proved their worth in the tests so far.

The Freedom Seven (seen below) and Liberty Bell capsules used by Commander Shepard and Captain Grissom on their sub-orbital flights earlier this year, are exactly the same as the one that will be used next year when the first American—probably Shepard again—makes three orbits of the Earth.

The Mercury capsule is shaped like a bell. The broad bottom is about six feet across, and the capsule stands ten feet high.

The spaceman hasn't a lot of room to move about inside.

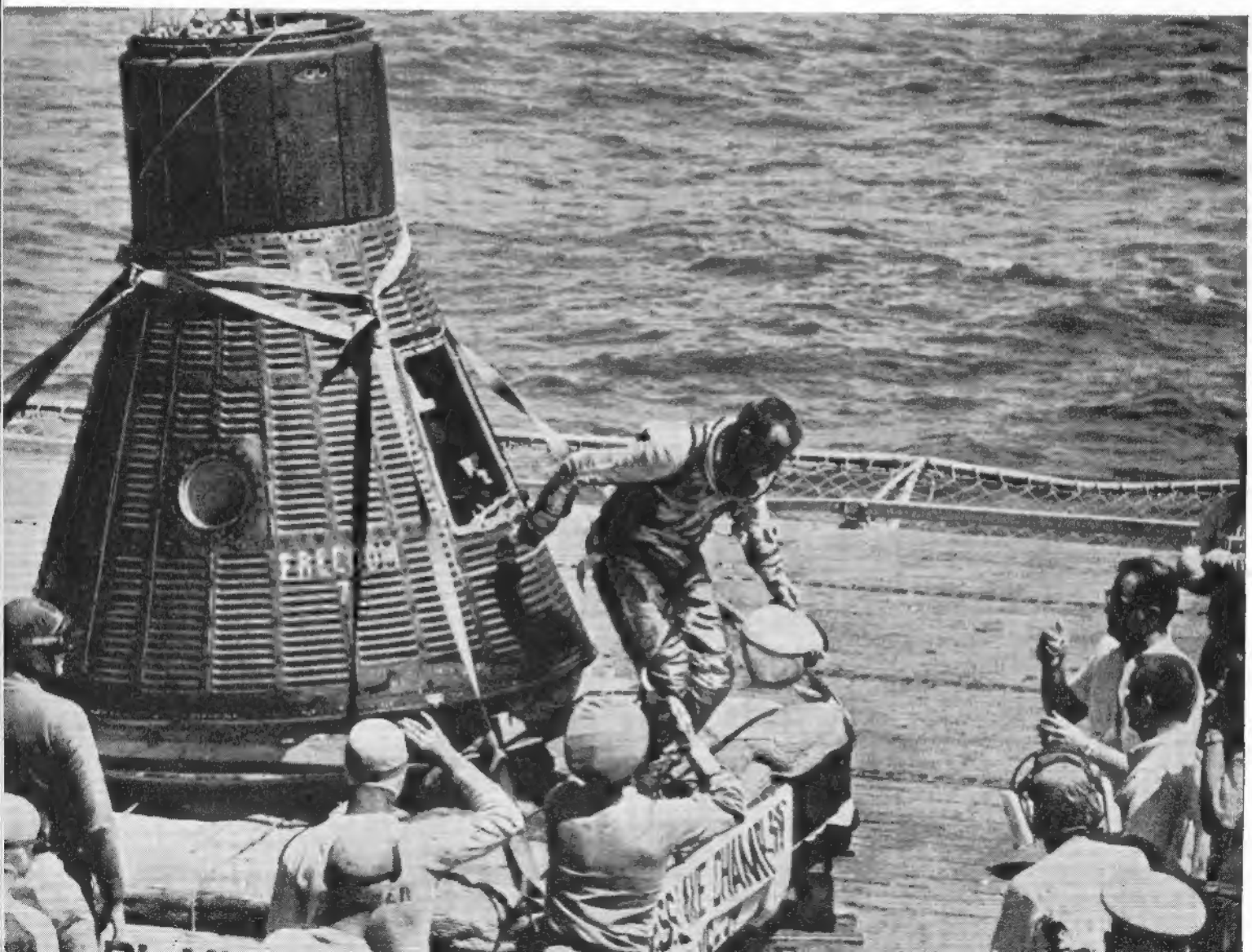
At the bottom of the capsule, he has his space-couch. This is of foam-rubber, tailored to his own body to keep discomfort to a minimum.

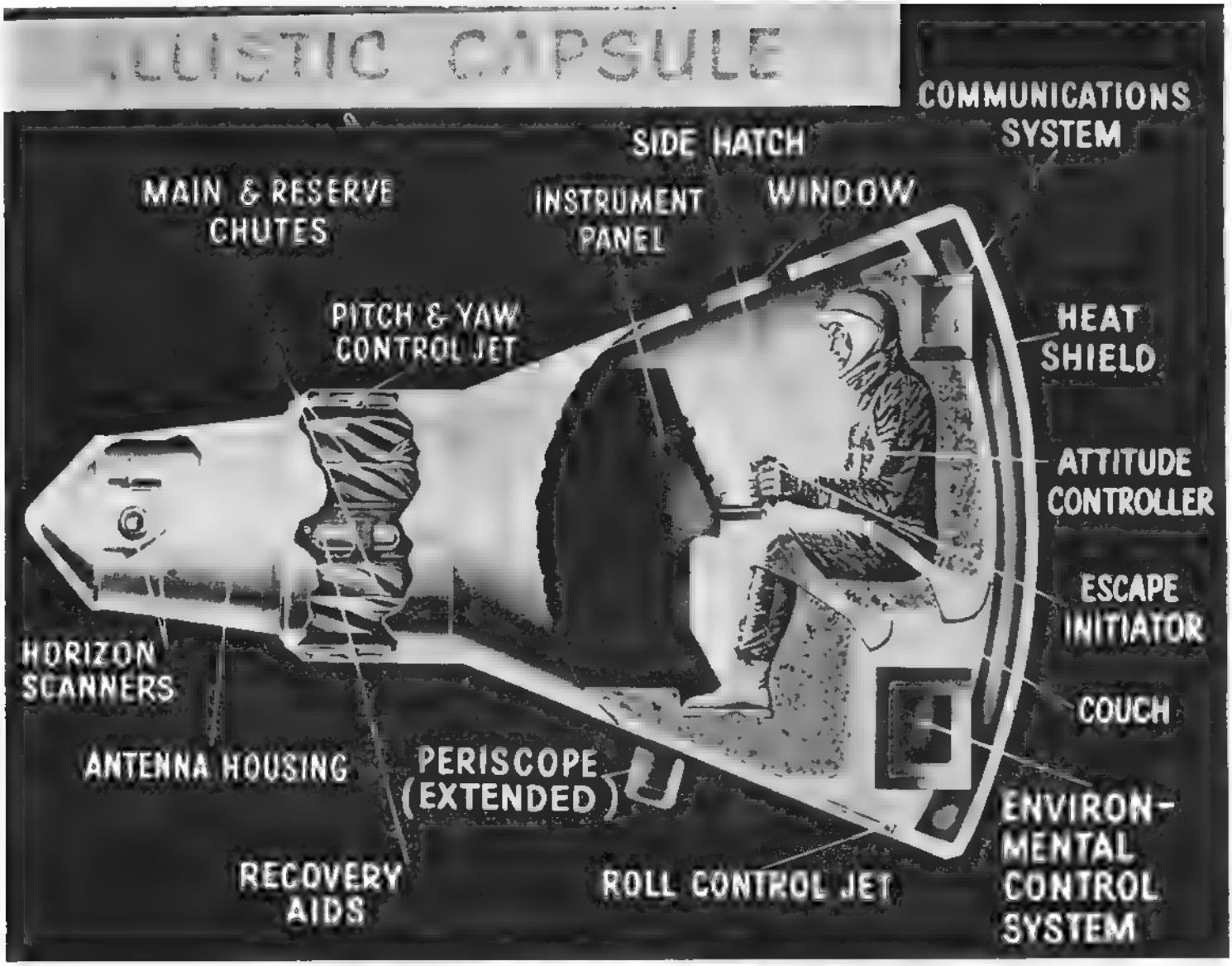
Getting settled on this couch is a tricky business. The only way into the capsule is through a small hatch. And the spaceman is wearing a 28-lb. silver space-suit and his space-helmet, both necessary to protect him should his space-ship spring a leak, as he climbs aboard.

To get into his space-ship, and to have technicians couple up his space-suit to the air-conditioning and communications systems built into the space-capsule, takes nearly an hour.

Getting out of the capsule is a tricky buiness, too. Each astronaut has to have first-hand experience of how to do this under difficult conditions.

To give them this experience, the spacemen were put inside a capsule, which was





HOW IT WORKS

then dropped into the Gulf of Mexico when a heavy swell was running.

The waves at the time were up to 10 ft. high. Each man had to make at least two successful exits under these conditions. All did. Some got seasick in the attempt.

To make sure that the astronauts could cope with any emergency, a carbon-copy of the Mercury space-ship was set up inside a hangar at Cape Canaveral.

Each astronaut "flew" it for hundreds of hours, without ever leaving the ground, before taking a real space trip.

SEVEN MILES OF wiring and 10,000 parts are needed to ensure that the space-ship works properly.

THE INSTRUMENT PANEL itself contains over 100 lights, fuses, switches and controls. It is set directly in front of the pilot. On the left are the navigational aids. On the right are the controls for the air-conditioning and radio-communication systems.

THE PERISCOPE gives the pilot a 360-degree view of the horizon. He can choose between "low" or "high" magnification. Low gives him a view of the Earth of about 1,900 miles in diameter, high of about 80 miles.

THE COUCH is made of a crushable honeycomb material bonded to a fibreglass shell and lined with foam rubber. The couch protects the spaceman's body from acceleration during blast-off and deceleration during re-entry.

THE ENVIRONMENTAL CONTROL SYSTEM takes care of the air-conditioning both in the cabin and inside the space-suit. Built into the space-suit are sensors, which are attached to the pilot's body. These record his heartbeat, temperature, and breathing-rate changes, and radio the information back to the ground.

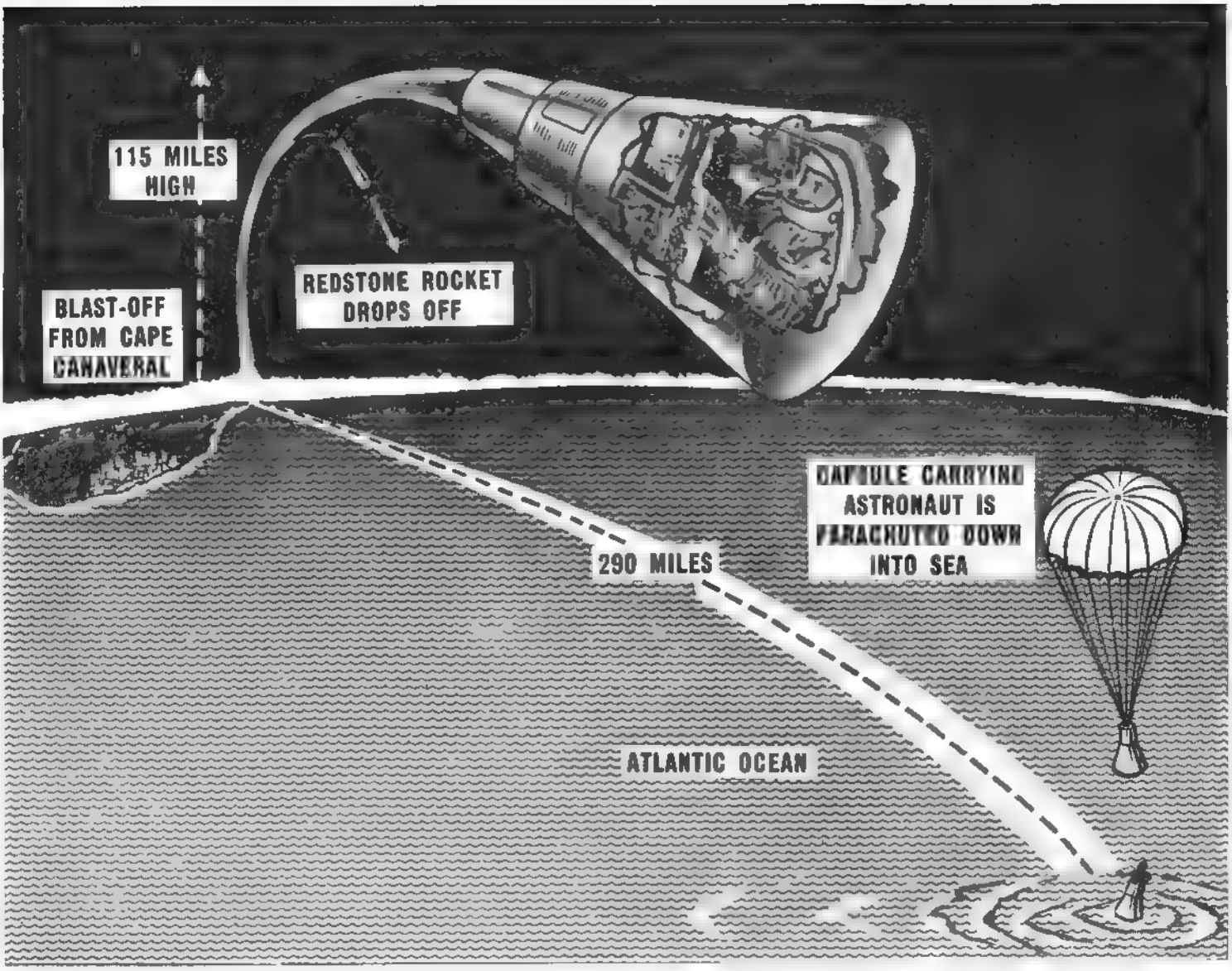
THE PITCH AND YAW CONTROL JET is operated by pressing buttons on the Attitude Controller. Using this enables the spaceman to change the position of his space-ship as it travels through space. He cannot steer it on a new course, but he can change its attitude.

FOOD AND WATER sufficient for 28 hours are provided in the space-ship. The food is chosen to provide the astronaut with the maximum of nourishment while producing the minimum of waste products.

RECOVERY AIDS carried in the space-ship include a special shark repellent, should the astronaut have to spend some time in the water before being rescued, and radio beacons, flashing lights, and powerful dye-markers.

THE PARACHUTES, carried in the nose of the space-capsule, help to slow it down on the last stages of the return to Earth. The first opens at 21,000 feet, the second, or main 'chute—red-and-white-striped—opens at 10,000 feet.

If weather conditions are ideal, the space-capsule hits the water at about 4 m.p.h. A 4-ft. rubberised fibreglass "skirt" opens to form an air cushion and ease the landing impact.



THE DIAGRAM ABOVE shows how Commander Shepard and Captain Grissom made their quick up-and-down trips to space.

The diagram below illustrates the next phase of the United States man-in-space plan.

This calls for one of the seven picked astronauts to make three trips round the globe. If all goes well, the attempt will be made early next year.

For the orbital mission, the astronaut will ride his Mercury space-capsule atop a 100-ton Atlas rocket, instead of the smaller 30-ton Redstone used for the sub-orbital missions.

Originally, there were to have been three sub-orbital flights before the round-the-globe mission was attempted. The third has now been cut out.

To pave the way for the round-the-world, trip, two Atlas shots have been made with " iron men "—metal dummies the size and weight of the real astronaut—aboard the Mercury capsule.

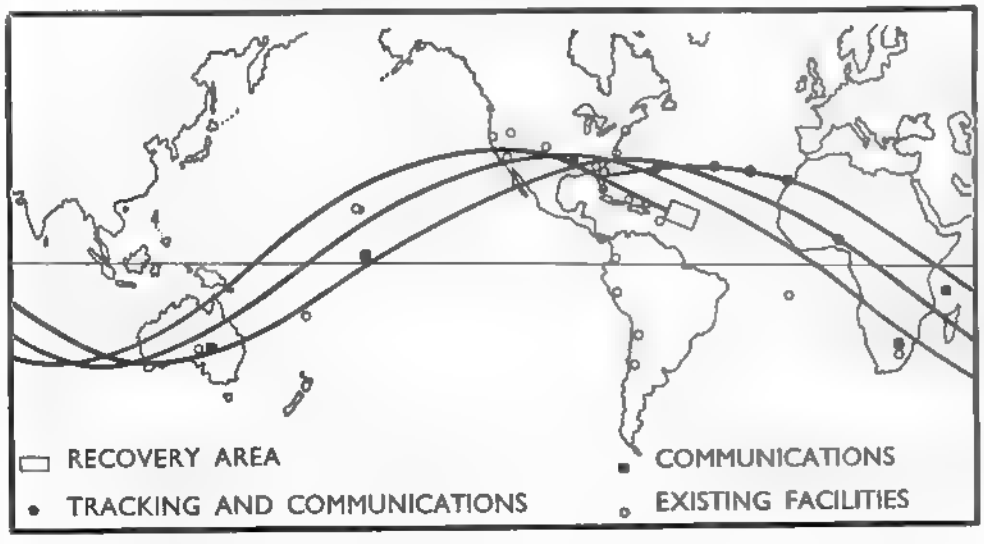
The dummies were fitted with instruments that duplicated human reactions. They breathed, talked, and even sweated, in space.

The first dummy shot, on April 25th, 1961, ended in disaster. The range safety officer at Cape Canaveral had to blow up the big Atlas rocket when it had gone three miles. But the test proved that the space-craft escape system worked well.

The second shot, on September 13th, was a success. The dummy went round the world once, taking 106 minutes from blast-off to splash-down.

Cape Canaveral will be the starting-point once more.

ORBITAL FLIGHT PATHS



THE LONG HARD ROAD INTO SPACE

THIS PICTURE SPELLED disaster for America's first space-hope.

In the heady summer of 1957, United States space plans were going well. It seemed that America would stake the first claim to space.

Then, as the autumn leaves reddened, so did the faces of America's top scientists.

On October 4th, Soviet scientists blasted Sputnik One into orbit

On November 3rd, while the world still marvelled and the United States was still stunned, the Russians sent their half-ton Sputnik Two into space, with the dog Laika aboard.

Preparations to get Uncle Sam's Sputnik into orbit were rushed ahead. But the [illegible]-in. diameter " moon " refused to rise and shine.

After several delays, the firing-button was pressed on December 6th. Immediately, there was a tremendous explosion.

The slim, 72-ft. Vanguard rocket, that [illegible] a few inches from the firing-pad.

And the grapefruit-sized Sputnik rolled from the nose-cone on to a corner of the launch-pad, where it bleeped away forlornly.

A Russian on the Moon?

BEFORE LONG—ALMOST certainly by 1970, possibly, even, by 1965—a man will stand on the Moon and look at the Earth.

This artist's impression gives some idea of what the first man on the Moon—he will most probably be a Russian—will see.

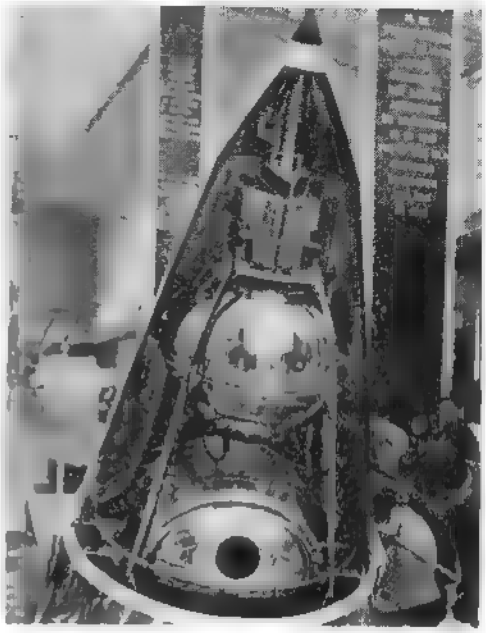
He will be too excited by the prospect of what lies ahead of him, and too homesick for what he left behind him, to think about the developments that enabled him to journey across the 240,000-mile gap between home and the Moon.

But to enable one man to have a view like this will mean the spending of billions of roubles and dollars, and the use of the brains and muscles of vast armies of scientists and technicians, in both the United States and the Soviet Union.

The slender transmitting aerials of Sputnik One (seen on the left) enabled the first bleep-bleep-bleep signals to be sent back to Earth from space—proving it was possible to GET there.

The dog that rode as a passenger in Sputnik Two (seen on the right) showed that it was possible to LIVE there, too.

And the refinement of the big rockets that launched the first Sputniks will lead to the building of the super-rockets that will not only be able to take man to the Moon, but bring him safely home again.



In the first four years of the Space Age, the Americans successfully launched 54 satellites and space probes, the Russians 15 more. In them, animals were first to tread the pathway to space. Where they led, men followed—all the way to the Moon.

THEY LED THE WAY TO THE STARS

He had no name—just a number.

He was one of the first monkeys to be trained for a space-trip.

[illegible] were enrolled at the [illegible] Dayton, Ohio.

Those who came out top of the class were given names. There was Able and Baker, Sam and Miss Sam. They took rocket trips that earned them big black headlines in the world's newspapers.

All that this forlorn little fellow got out of space research was a big black headache.

He had to learn to press buttons when lights flashed and buzzers sounded. If he did things right, he got an apple. When things went wrong, he got a mild electric shock.

Here he is, all alone in his little space-chamber. Wondering what the hell is going to happen next.

He helped make space history, but never rated even a mention by name.

THE WHOLE WORLD loves a dog.

The Russians proved this fact when, on a cold, bleak Sunday morning in November, 1957, they announced that a dog was a passenger in their second Sputnik, launched early that morning.

The howl that followed this disclosure echoed round the globe.

In London, Washington, and other major cities of the world, angry animal lovers bombarded Soviet Embassies with protest calls.

In Britain, dog-lovers called for a one-minute silence for the animal in the space-kennel, and old-age pensioners sent some of their savings to the animal protection societies.

Hundreds of miles out in space, however, whirling round the world at 18,000 m.p.h., the dog herself showed that she was standing up extremely well to space travel.

Whatever the fuss going on down below, she was all right.

A continuous record of her heartbeat-rate, breathing-rate and blood-pressure, bleeped back to the Soviet Space Kremlin, proved this.

The space-dog was Laika, sometimes called Curly. She weighed just under 12 lbs. She had a keen, intelligent face, and kept her ears pricked up all the time.

Some said she was part-Samoyed, others that she had Arctic husky lineage. The Russians said frankly that she was a mongrel. "Her genealogy," said an official announcement, primly, "is not known."

She was just a street stray.

But she became the world's first space-heroine.

She had an exhaustive training for her historic space mission.

Months before Sputnik Two went to the launch-pad, Laika had a space-suit put on her for the first time. She wore it for a few minutes at first, then for longer periods as she got used to it.

Next, she had to learn how to move around with recording instruments strapped to her body.

Then she was taken into hermetically sealed rooms, prototypes of the space-cabin in which she would live and die. She spent several weeks in one of these rooms.

Laika learned to sit patiently on metal tables that trembled and shook, duplicating the effects she would feel at blast-off.

And she became accustomed to the terrifying roar of rocket motors bellowing

THE DOG THAT DIED

at full throttle for periods up to two minutes at a time.

Like most mongrels, Laika was sweet-dispositioned, even-tempered, and very lovable "She never quarrelled with the other dogs in the animal house," said one of the technicians in charge of her.

The Russians, like the British, are great dog-lovers. Laika, like all the Soviet space-dogs, was handled with great care and affection.

When she went up in a rocket for her first flight—it was a brief up-and-down shot that took her about 100 miles above the Earth she showed no sign of fear.

When she came down again and was released from her harness, she jumped excitedly into the arms of the dark-haired, 30-year-old woman, Dr. Zoya Skourazina, who was in charge of her.

Throughout the ten days that Laika lived in space, her reactions were continously recorded. The records showed that, apart from a little nervousness during the first stages of blast-off, she quickly settled down to her changed conditions, and, in particular, adapted well to weightlessness.

Laika was fed by means of a robot cafeteria. It provided her at regular intervals with highly concentrated pellet foods, and with water, under pressure, to drink.

There was great speculation about whether Laika would be brought back alive or not. Russia's top space scientist, Academician Anatoly Blagonravov, gave the world the sad news in an exclusive interview with the *Daily Mirror*.

The dog, he said, would die in space. She did, painlessly—when her air supply ran out.

—AND MADE FRONT PAGE NEWS

SPACE MIRROR No. 5 NOV 5 SPACE YEAR ONE

Exclusive! Space Mirror man talks to Russia's top satellite scientist, who says there is—

NO HOPE FOR THE SKY DOG

By RONALD BEDFORD

THE little Russian space dog is doomed to die. This dramatic news was given exclusively to Space Mirror yesterday by Professor Anatoly A Blagonravov, 63, the Stalin prizewinner who heads the Soviet Union Satellite Project.

He holds the rank of Lieutenant General in the Soviet Army.

Every time the 18,000 m.p.h. space-kennel makes a trip round the globe, the shaggy-haired dog inside it has 102 minutes less to live.

For there is NO braking system in Sputnik II that could be used to slow down the satellite and give it a chance to re-enter the Earth's upper atmosphere in time to save the dog's life.

A telephone call I booked to Professor Blagonravov came through at lunch time in London—mid-afternoon in Moscow. Russian-speaking colleague Frederick Wills asked these questions for me, and translated Professor Blagonravov's replies. Is there some braking system in Sputnik II to enable it to return to Earth?

AND THE CHIMP THAT LIVED...

HAM GETS HIS REWARD...

THIS IS HAM, the 37½-lb. champ of the chimps.

He is only three years old, but already he has been for a space-ride, and written a page in the space history-books.

Ham is one of the chimpanzees that United States scientists have trained for space missions. Others are named Minnie, Elvis and Tiger.

Ham's big moment came on the last day of January 1961.

The scientists in charge took him for a walk along to Pad Five at Cape Canaveral, Florida. Under his tiny space-suit, he wore a nappy.

The scientists settled him into the driver's seat of the one-ton Mercury space-capsule, and he was ready for the off.

What Ham said when blast-off took place nobody will ever know.

But the television camera mounted in his capsule showed clearly that he took a poor view (see opposite page) of the early part of the proceedings.

The strain on his face was caused by the forces of acceleration, which made his body seem seven times heavier than usual.

Because a chimp is no chump, space-scientists give him work to do when he rides a rocket.

In Ham's case, this involved working levers in front of him. On his space-dashboard he had three lights—white, blue and red. In front of the blue and red lights were blue and red levers.

Ham had to pull the red lever every 20 seconds, and the blue one every time the blue light shone. He never knew when this would happen.

The white light? That told him he had done the job properly, and tipped him off that his reward—a banana-flavoured pellet—was waiting.

Ham had been trained to do these tasks on the ground, and he rarely missed a pellet. He did equally well in space, the scientists found—proving that being weightless did not impair his ability to remember and obey.

During his brief space-ride, which lasted 16½ minutes, Ham travelled at 5,000 m.p.h., went 155 miles into space, and 420 miles out from the launch-pad.

This took him higher, and sent him farther out, than either of the two American astronauts, Commander Shepard and Captain Grissom.

Ham's main job was to prove to them, and to the scientists in charge of the United States man-in-space programme, that space was safe for a champ chimp, and so for men, too.

When they fished him out of his capsule at the end of his ride, Ham chattered gaily, shook hands with his rescuers, and then had supper—an apple, half an orange, and a lettuce.

As you can see from the grin on the superchimp's face, he was pleased to be back on solid ground.

Your Gallery

THE PUP WITH the eye-patch and the cuddle-me look is Strelka. The name means Little Arrow.

The one with the more serious look is Belka. The name means Squirrel.

Both starred in the dramatic "bring-'em-back-alive" space-flight Soviet scientists carried out in August, 1960.

The Russians blasted a whole Zoo into orbit 200 miles above the Earth aboard their 4½-ton Sputnik.

In addition to the two dogs, black and white mice, white rats, guinea-pigs and flies went along for the trip.

Twenty-four hours after blast-off, while the Sputnik was making its 18th orbit, a radio signal commanded it to come down.

The dogs, and the other animals, were brought back to Earth without a scratch. They were the first living things to cross

# of Space Pets

the space-frontier, stay out there for a day, and come home again.

During their space-stay, they travelled nearly 435,000 miles. That is almost the distance of a trip to the Moon and back.

The dogs were not strapped down in the Space Zoo. Television cameras aboard the big Sputnik sent back to the ground continuous pictures of how they fed, slept, and behaved.

They wore special space-suits—green for Belka, red for Strelka. Instruments inside kept continuous track of their heartbeat and breathing-rates.

The TV cameras showed that the dogs pricked up their ears and looked anxious during blast-off. The tremendous force of acceleration pinned them to the floor.

When in orbit, and they were weightless, they floated about the cabin. Their heads and limbs were limp, but they soon got used to being weightless.

Their heartbeat and breathing-rates soon returned to normal, and they tucked into the space-meals provided for them by a robot cafeteria in the big space-ship.

As soon as they had been released from their space-ship, the two dogs enjoyed a good meal. But they turned down a plate of savoury sausage in favour of a sweet. Then they had a bath.

Exhaustive medical checks showed that they were in tip-top condition. They had no scratches or bruises.

Soon after they returned to Earth, the dogs were taken to Moscow. There, they held a Press conference. They were frisky, friendly, and completely at ease.

Neither the photographers' flashbulbs nor the brilliant TV lights bothered them in the least. But in spite of many efforts to make them bark, they stayed silent.

The Russians did not bother to name the rats and mice that were fellow-travellers in space with Strelka and Belka.

French scientists, however, had a name for their Desert Rat space-hero, pictured on the right. He is Hector.

All dressed up in his space-suit, white rat Hector was photographed just before blast-off from the French Cape Canaveral at Hammaguir, near Colomb Bechar, in the Sahara on February 22nd, 1961. He had only three minutes in space, and went 93 miles above the Earth in the nose-cone of a 23-ft.-long Veronique rocket.

He landed 28 miles from the launch-pad, and a helicopter took him back to base for a medical check. It showed that Hector was fine and dandy. Space-travel didn't upset his routine.

A month after he rocketed above the clouds, Hector became the father of four. Six weeks later, he had added another 14 to his family.

Your Gallery of Space Pets

STRELKA LIVED TO HAVE A FAMILY

THIS QUARTET OF doggy mischief looks "out of this world."

And each dog HAS been out of this world, and round it, too.

The four Soviet space-heroines, in the picture above, from left to right are:

STRELKA (Little Arrow). With Belka, extreme right, she was in the first space-ship to be brought back from orbit.

CHERNUSKA (Blackie). First passenger in Vostok, the space-ship in which Yuri Gagarin rode.

ZVEZDOCHKA (Little Star). Second passenger in Vostok.

BELKA (Squirrel). She partnered Strelka on her space-trip.

Five months after her return to Earth, Strelka had puppies. Six of them. All healthy. One, called Pushinka (Fluff) was given by Mr. Krushchev to Mrs. Jacqueline Kennedy, wife of the United States President. Fluff is third from the right in the picture below

BELKA—in Space

HERE IS SOVIET space-dog Belka (Squirrel) —IN SPACE.

The photograph was taken from the TV screen at Russia's Space Kremlin. Throughout the 24-hour space-ride, TV cameras inside the space-ship kept watch on Belka and her companion, Strelka, to see how they reacted to their out-of-the-world life.

The TV screen showed that the dogs were not too happy during blast-off. They also took time to settle down to orbital weightlessness. But they soon adapted themselves to space life.

Two more who made the rocket trip

THAT WAS FUN, wasn't it ?

This is what the dog, Courageous, seems to be saying to the rabbit, Little Martha, when both got their breath back after a rocket-trip they took together in July 1959.

The Soviet animals did not go into orbit. Their trip, which lasted only a few minutes, took them between 100 and 200 miles above the Earth.

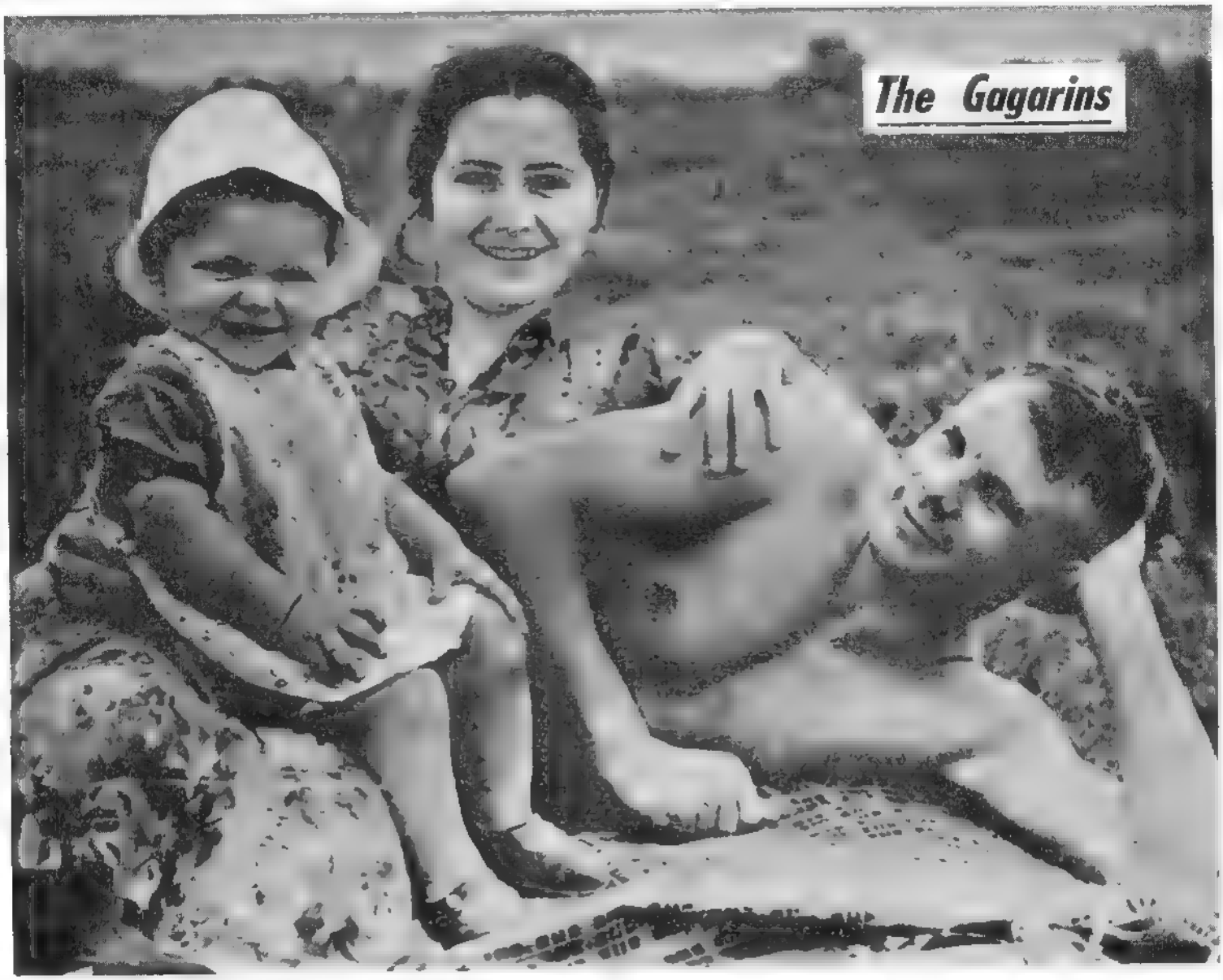
Courageous and Little Martha became firm friends as a result of their rocket ride.

The dog regularly helped the rabbit to keep spick and span, Soviet scientists reported, by washing her with his tongue.

A fortnight later, Courageous was off again on a rocket trip. This time, Little Martha stayed on the ground.

And she remains (as far as the records show) the only rabbit ever to twitch her whiskers in space.

SPACE MEN



MEET THE GAGARINS—in holiday mood.

Yuri is 27. Valentina—he calls her Valya—is a year younger.

Elena is only two, but since this picture was taken, they have had a second child, another little girl, called Galya.

Today, the Gagarins live in a big Moscow apartment. It is a big improvement on the two-roomed flat in which they lived before Yuri rode into space.

In those days, space was, for him, something to be conquered

But for Valya and little Elena, it meant anywhere away from the flat—such as a happy day in the sunshine.

AT HOME

THE GRISSOMS ARE very popular with the neighbours in Newport News, Virginia, where they live.

His birth certificate lists the astronaut as Virgil Ivan, but everybody calls him Gus.

Grissom is 35. When the United States picked a short-list of three astronauts, from the seven in training, he was the " baby " of the finalists.

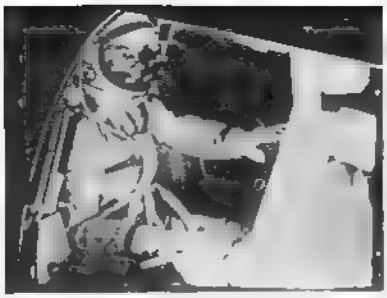
He is dark-haired and less boisterous than his wife Betty, who is two years his junior. They have two sons, Scott, 11, and Mark, 7.

Mark's greatest moment came when the teacher let him tell his class, at the Reservoir Elementary School, Newport News, about space-travel.

The picture shows that he made a good job of the lecture. With the aid of a chair and a space-helmet Mark demonstrated how Dad coped with the problem of blast-off.

Gus Grissom's greatest joy is to take the boys off for a fishing trip. When his space-shot had to be called off for 24 hours, Gus went fishing down at Cape Canaveral

SPACE MEN AT HOME



The Shepards

ALAN SHEPARD, 37, was shy and reserved before he went into space. His rocket-ride didn't change him.

But his shyness is offset by the friendly manner of his pretty wife Louise, 34. They make a perfect pair.

When brown-haired Alan's manner seems abrupt to strangers, it is brown-haired Louise's frank, ready smile that melts any impression of aloofness.

The Shepards are both deeply religious. No meal begins, in their pleasant home at Bay Colony, Virginia Beach, about 200 miles from Washington, without a moment of prayer.

The Shepards have two daughters, Laura, 13, and Juliana, 9.

Of all the astronauts, Russian or American, Alan Shepard is the tallest. He stands one inch under six feet.

He was a jet-fighter test pilot before he became an astronaut. Off-duty, he plays golf, ice-skates in Winter, and goes water-ski-ing in Summer. He is also a cine enthusiast.

Millions all over the world, watching the TV coverage of Alan Shepard's triumphal reception in Washington, after his space-trip, saw the glow of wifely pride on Louise's face every time she looked at her husband. It shone out like a searchlight.

But her essentially feminine touch peeped through when she and Mrs. Jacqueline Kennedy, the President's wife, walked off, arm in arm, to talk about fashions while their menfolk discussed space-travel.

SPACE MEN  AT HOME

The Titovs

A SPACEMAN'S LIFE is all ups and downs.

UP he goes into space, to make seventeen full orbits of the Earth.

DOWN he comes, to a hero's welcome. And, like many another husband who has had a fill of excitement and adventure, back to a hand with the household chores.

The man in these homely pictures is Major Gherman Stepanovich Titov, 26, Russia's second cosmonaut.

He knows more about space-travel than anyone else because he has spent more time in space—25 hours 18 minutes—than anyone else.

But he comes from down-to-earth stock. His great-grandparents, on both sides of the family, were peasants.

He is married. His wife, Tamara, is 24. The happy holiday picture of them was taken at a Black Sea resort. They have no children—yet.

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HUMAN BRAINS AND robot brains have worked side by side to make millions of calculations.

Hundreds of engineers have poured out their skill into fashioning the tens of thousands of complicated parts that are needed to make a big rocket.

Now, out there on the firing-pad, stands a £2,000,000 tribute to their efforts.

The big rocket is ready to go. The long hours of testing and checking, re-testing and re-checking, are over.

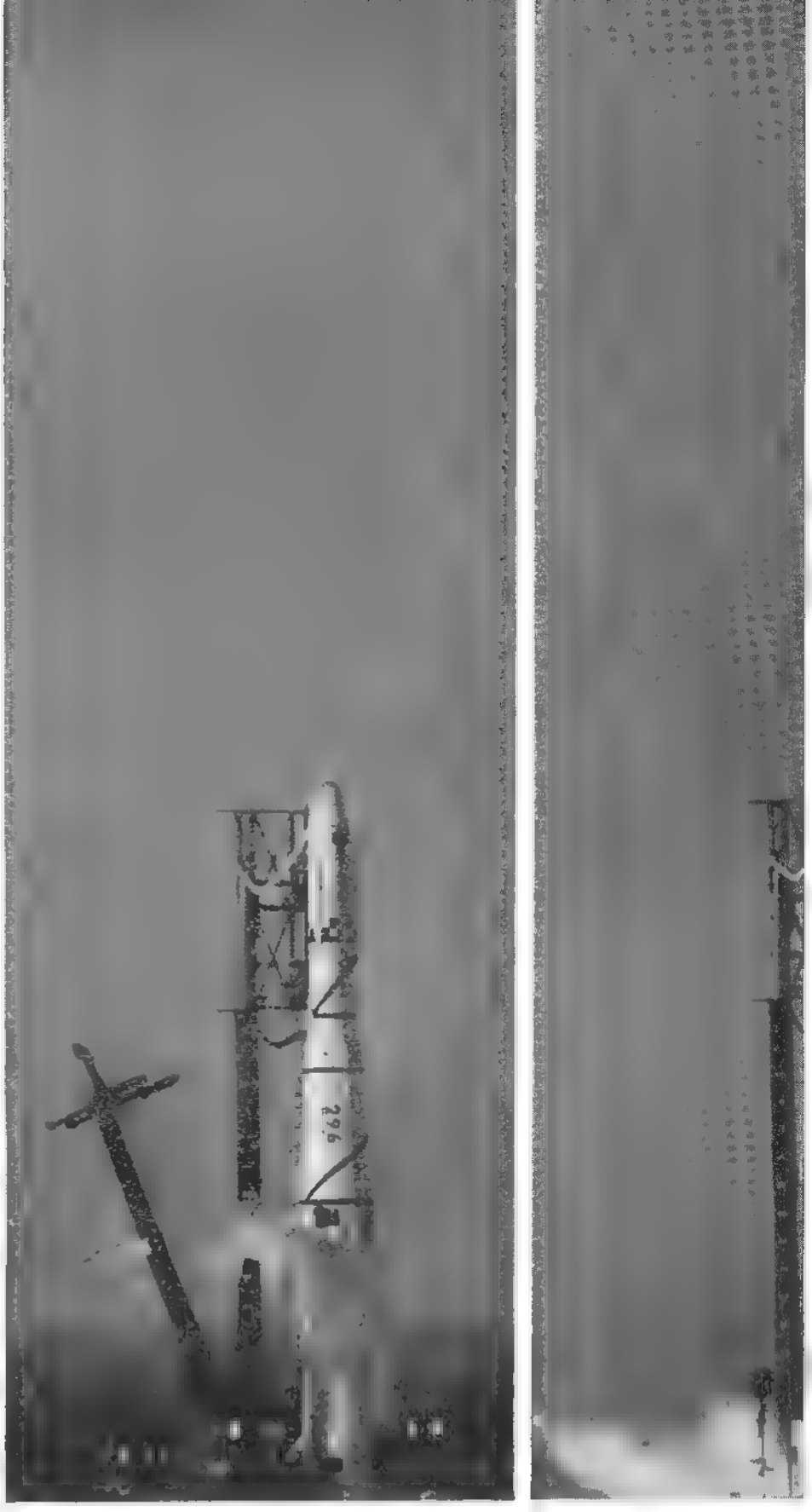
Deep underground, in the control centre, the men in command are tense and silent. A vast network of electronic eyes and ears stands by to write another page in the history of man's endeavour to reach the stars.

Will it be triumph or tragedy ? Will the scientists and engineers have to go back to their blueprints to find out what went wrong ? Or will they go off for a celebration ?

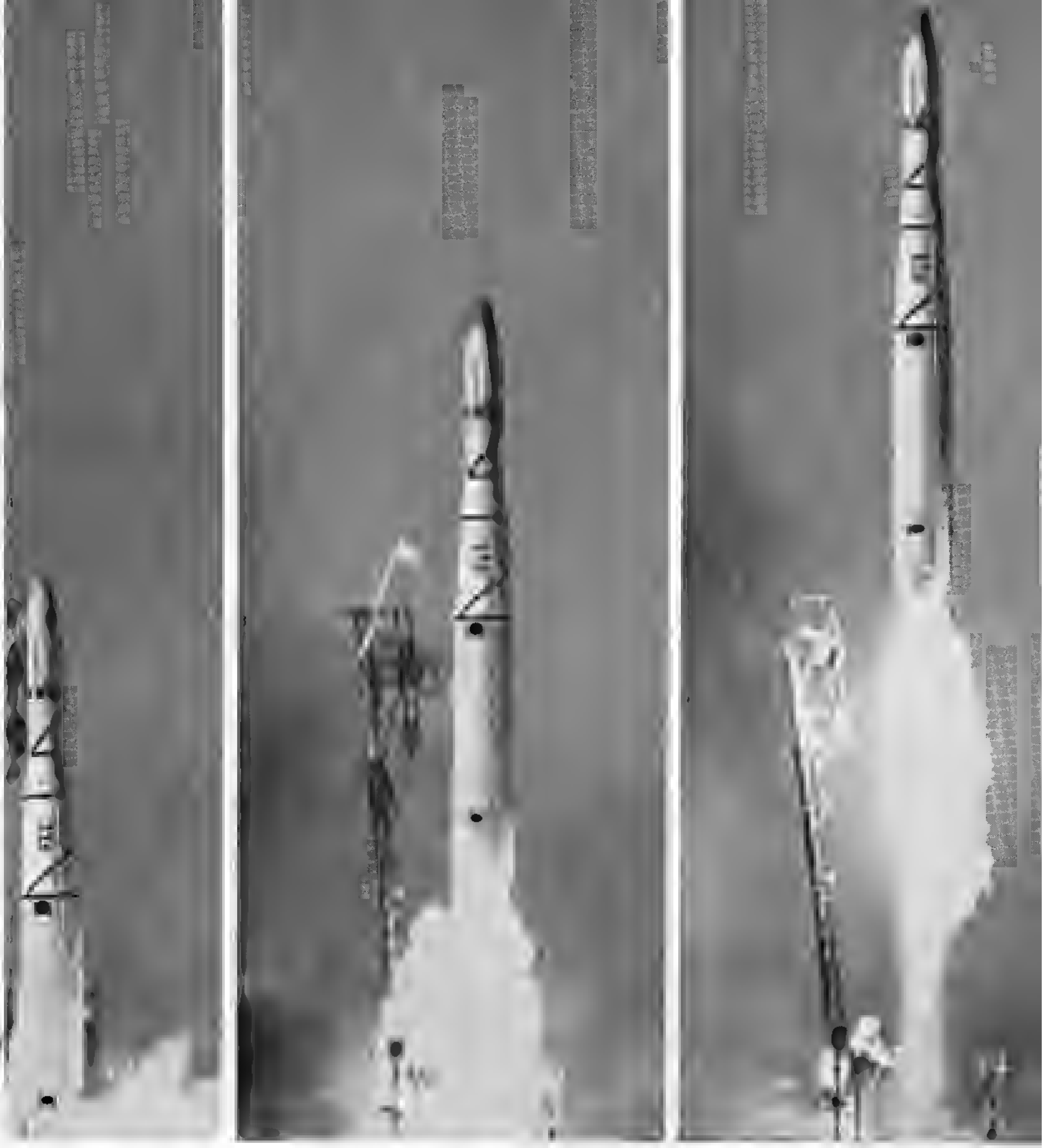
The voice of the launch controller booms out over the squawk-boxes in the control centre and on the now-deserted firing-pad.

He tries to keep his voice calm as he calls out the last seconds. Six . . . Five . . . Four . . . Three . . . Two . . . One . . . ZERO.

Only the high-speed cine-camera sees the moment of truth as America's Polar-orbiting Discoverer satellite roars off to a perfect launch.



BLAST-OFF FOR



THE FUTURE ▶

THE MAN (of the future) IN SPACE

A MAN NEEDS to wear special clothing to make even a brief trip into space.

His body must be protected against the forces of acceleration at blast-off, and against even greater deceleration forces encountered during re-entry into the atmosphere.

These forces are known as High-G, or high gravity.

At blast-off, the additional pressure exerted on the body is six or seven times that of normal gravity. A ten-stone man, under a 6-G load, feels the weight of 60 stones pressing on him.

During re-entry, the G-factor can be double, even treble, that at blast-off.

Without protective clothing, a spaceman would not survive such forces for long without serious injury.

A space-suit contains bladders, which can be filled with air or liquid, and which inflate automatically as the G-forces mount.

They do not remove the whole of the strain from the spaceman, but they enable him to counterbalance much of it. People who heard the dramatic second-by-second broadcast made by Commander Alan Shepard, the first United States astronaut, will remember how his voice trailed off almost to a gasp as he experienced the crushing 12-G of re-entry.

In orbit, a man's need of protective clothing is even greater.

His space-suit must also provide him with every breath of air he takes, and look after the job of keeping his body-temperature even.

These functions are carried out by equipment in the space-cabin, but they

THE MAN (of the future) IN SPACE

must be duplicated in the space-suit . . . just in case the space-cabin is hit by a tiny meteorite, causing the system to leak.

Research work costing millions of dollars was carried out in the United States to develop space-suits for the men picked for the Mercury man-in-space programme.

The suits were tested under the most severe conditions.

To prove their efficiency under high-G loads, the spacemen donned the suits, and wore them while riding in the human centrifuge at the Naval Research Laboratory at Johnsville, Pennsylvania.

The centrifuge is a machine like the "whirling arm" at a fairground. The picture opposite shows astronaut Donald (Deacon) Slayton, 36, coming out of the centrifuge gondola after testing the suit finally chosen as standard gear for America's spacemen.

The test programme revealed that some minor, but very important, modifications were necessary.

For example, the earlier-model suits had only one throat zip-fastener, down the centre. The tests showed that this prevented the spaceman from properly swallowing his Adam's apple, a well-known tension-revealing movement, during moments of stress.

The suit finally developed had two zip-fasteners, one at each side of the throat.

The test programme also showed that there was need to provide the flexible fingers of the space-suit gloves with a locking device.

This enabled the spaceman to make any finger permanently stiff—a great help when he needed to press buttons on the control console.

Another problem that had to be overcome involved soundproofing the space-helmet. When a rocket blasts off, the man in the space-cabin hears a din that sounds like two pneumatic drills going full blast inside a telephone box.

New soundproofing materials were developed and tested which helped to cut the din down to minimum levels.

Scientists in the United States and the Soviet Union are now putting a great deal of effort into the design and development of space-suits that a man can wear on a journey to the Moon—and that he can wear in comfort when he gets there and walks around away from his space-ship.

The Russians have not released any details or pictures of what their Moon-suits will look like.

The Americans, however, have. The picture above shows the Moon-suit developed by the Republic Aviation Corporation.

It looks like a washing-machine at first glance, but it has a built-in air-conditioning system, with temperature-regulating devices.

It also has a built-in tripod, which the spaceman can lower to take his weight and provide him with support while he enjoys a well-earned rest.

LOOK! NO WEIGHT!

ONE OF THE most important discoveries Soviet Spaceman Major Titov made during his day in space was that weightlessness can be the bogy it was feared to be.

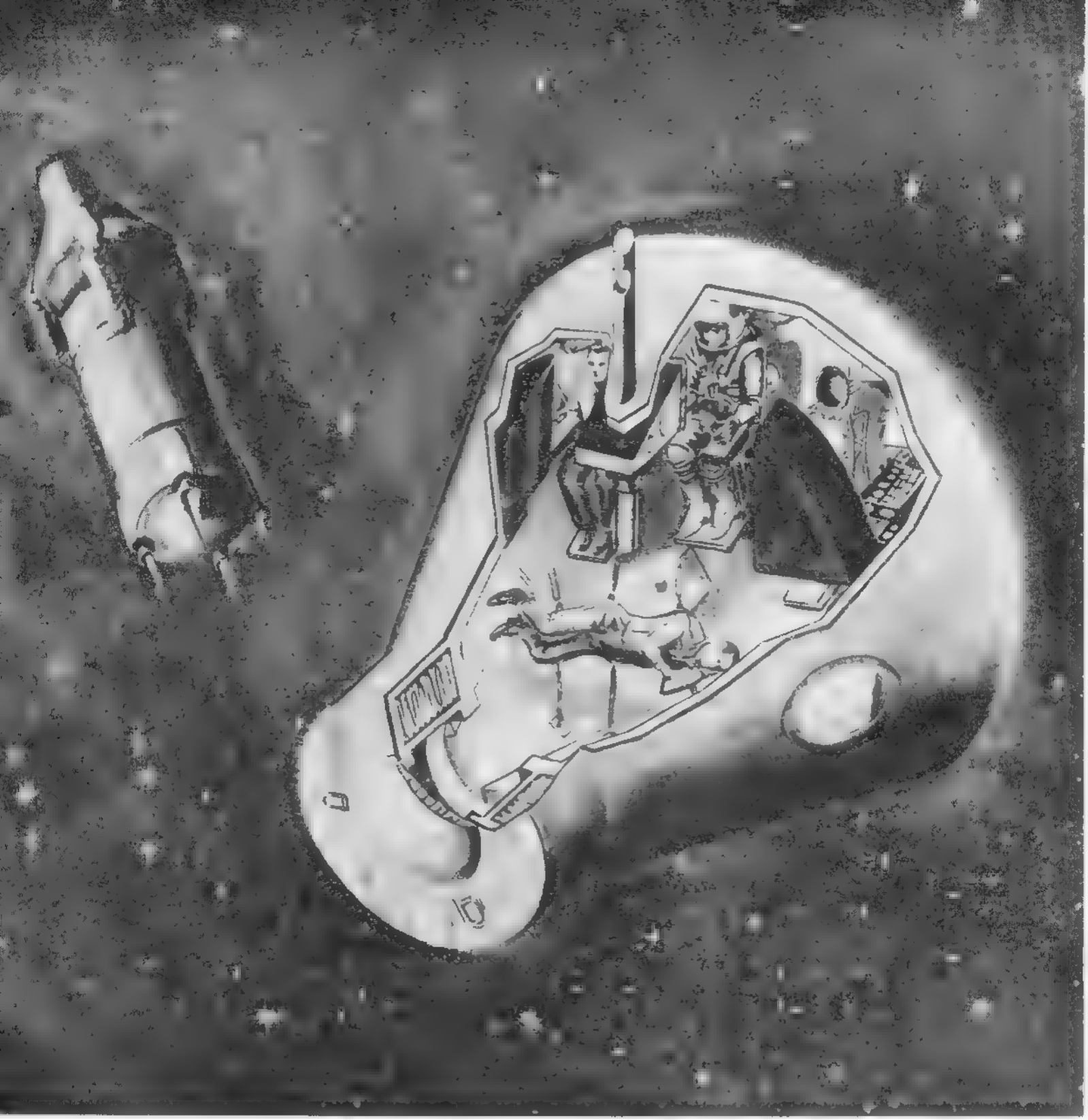
He was "space-sick" most of the time.

Most people have experienced weightlessness for a fleeting moment. When a speeding car goes over a bump in the road, when a fast-moving lift is descending, or during the first split-seconds of the over-the-top ride on a fairground roller-coaster, you are momentarily in "free-fall," and so weightless.

Weightlessness does not begin at some magic distance from the Earth. For the spaceman in sub-orbital flight, it starts when his rocket motors cut out, and he begins "free-falling" back to Earth.

For the orbiting spaceman, weightlessness starts when the force with which he was flung outwards, his orbital velocity or forward speed, exactly balances the downward pull of the Earth's gravity, cancelling out his sense of weight.

But weightlessness is not something the spaceman imagines. If he is not



strapped down, he floats about in his cabin. So does everything else in it that is not anchored.

If he tries to drink, water in a glass will hit him in the eye. If he tries to cut a chunk off a piece of steak, the force he uses to wield his knife will push him out of his chair and make him bump his head on the roof.

That is why space eating and drinking must be done out of toothpaste-type tubes, forcing food and liquid into the mouth.

Sleeping on a strap!

Men can experience weightlessness without riding rockets or Sputniks. They do so by travelling in aircraft flown on roller-coaster trajectories.

The picture opposite shows two of the top space research experts in the United States experiencing weightlessness. The man on the left is General Oliver K. Niess, the man on the right Colonel John Paul Stapp.

The picture above is an artist's impression of how one of the crew of the three-man space-ship Apollo, which the United States is building to take men to the Moon and bring them back, may take a nap—anchored by straps.

TARGET FOR TOMORROW

LOVERS, POETS, AND pop singers swear by it, scientists study it, some people are mentally disturbed by it, and now the two greatest nations of the world are engaged in a race to reach it.

The Moon has always fascinated men—and women.

It is not, as some people think, at a fixed distance from the Earth.

It does a kind of dreamy waltz in space, coming as close as 226,000 miles, then wafting as far out as 252,000 miles. The space-waltz is slowly taking the Moon farther away from us.

Some scientists estimate that it will go out as far as 340,000 miles, then come back towards the Earth and disintegrate.

Don't worry. If it happens at all, it won't be for 50 million years or so.

The diameter of the Moon is 2,160 miles—about a quarter that of the Earth. Average speed at which it moves round the Earth is 2,287 miles an hour.

The Moon has no light of its own. It reflects sunlight. Not very efficiently, either. Scientists reckon that moonlight, at its brightest, is only about one half-millionth the power of sunlight.

Putting it another way, the full Moon on a cloudless night yields as much light as a 40-watt bulb at a distance of 15 yards.

The Moon reflects Earthlight, too. When the Moon is only a silver sliver in the sky, just before or after new Moon, you can see the rest of it in a kind of "ghostlight."

This phenomenon is known as "The Old Moon in the New Moon's Arms."

Earthlight, shining on the night side of the Moon, produces this effect.

Another odd thing about the Moon is this. If you bend down and view it through your legs, it looks smaller than when you see it standing up. Nobody knows why.

The Moon always keeps the same face to the Earth. The spaceman who roams far from the lunar Poles won't see the Earth at all, for the same reason we never see the far side of the Moon.

But it is incorrect to say we see only half the Moon. In fact we see about three-fifths of it. This is because the Moon wobbles a bit. Scientists call the phenomenon "libration."

During libration, the Moon tilts first one Pole, then the other, towards us, giving us a view over the top or under the bottom. At one time or another, because of this, we can see 59 per cent. of the surface.

The "seas" of the Moon are flattish plains. There is no water on the surface. Astronomers, however, are careful not to say that water never existed. It is just possible that small amounts were there once.

The mountains on the Moon are majestic. The highest peak is in the Leibnitz Range, close to the lunar South Pole. This reaches to around 30,000 feet. The latest map of Everest puts the height of the Earth's highest mountain at 29,028 feet.

The craters on the Moon are immense, too. The biggest, known as Bailly, is 180 miles across. It would hold several English counties. The deepest, Newton, drops down 30,000 feet from the rim. You could put Everest inside.

As far as we know, the Moon has no atmosphere.

Many intriguing questions about the Moon will be answered only when the first men get there.

This may be as early as 1965. The Russians have set 1968 as the target for putting men on the Moon. By the early 1970s, many of the things we now do not know should be answered for us.

Life for the first men on the Moon will be no picnic. Temperatures will range from 250 degrees Fahrenheit, above that at which water boils, during the lunar midday to minus 200 Fahrenheit or more during the lunar midnight. The Moon-day is a fortnight long. So is the Moon-night.

The Moon has no atmosphere, and sound cannot travel in a vacuum, so the Moon will be a silent world. All that the spacemen will hear will be the voices of their friends over the intercom in their space-helmets—and their own breathing, also inside the helmet.

Life on the Moon, however, will have compensations.

Astronomers forecast that one of the most spectacular sights, something the Moon-men will never forget, will be the rising and setting of the Sun.

As there is no atmosphere on the Moon, there will be no subtle colour changes, which make sunrise and sunset on Earth so memorable, to see.

Instead, the Sun will be seen, for a whole hour, as it is rarely seen on Earth—during the few short minutes of total eclipse.

As sunrise approaches, the experts forecast, the Moon-men will find the pitch-black sky being illumined by the pearly light of the corona, like ice-cold moonlight.

Then, as the Sun's disc comes up above the horizon, they will see great gouts of flame, like the forked tongues of serpents, shooting out from the Sun.

The Moon-men will have to carry around with them their own air supply at all times. Water, too, if they move far from the space-ship.

This won't be such a big problem, however, as gravity on the Moon is only one-sixth that of the Earth. The man who can heft a hundredweight of coal on his back on Earth will carry six hundredweight on the Moon without flinching.

The Moon-men will also walk with big leaps and bounds, because of the gravity-difference. They will also fall in slow-motion.

For many years, astronomers reckoned there should be at least one more Moon circling the Earth. In July, 1961, Polish astronomers found and photographed TWO objects travelling around the Earth in the Moon's path. They think they are either a swarm of meteorites or a swirl of gas.

FOOTNOTE

The picture of the Moon, opposite, was taken at the Lick Observatory, California. It shows the lunar North Pole to the bottom. Astronomical telescopes always invert the image.

MANCHESTER MAPS THE MOON

WHAT HAPPENS IF I get lost? This is going to be a major worry for the first man to set foot on the Moon.

He won't be able to knock on the nearest door and ask the way back to his rocket-ship. Up there, his best friend will be—A GOOD MAP.

Scientists at Manchester University are now hard at work on a special project to provide the lunar explorers with just that.

They are preparing the most accurate map of this side of the Moon that can be made until the job is tackled on the spot.

It is a three-nation project. The final map won't be ready for several years—but still in time for the first men to take the maps with them when they blast off on their next-stop-Moon flight.

First results, however, of the new Moon-mapping project are available. You can see, on the right, a section of the new Moon-map produced by the three-nation team. As new facts become available, the map will be brought up to date.

Essentially, however, what you see on this page is a section of the map that the first spaceman will hold in his hand when he steps down from his rocket-ship and goes exploring on the Moon.

It won't matter whether the lunar voyager is American, Russian, British or Chinese. The Manchester map will be made freely available to all nations.

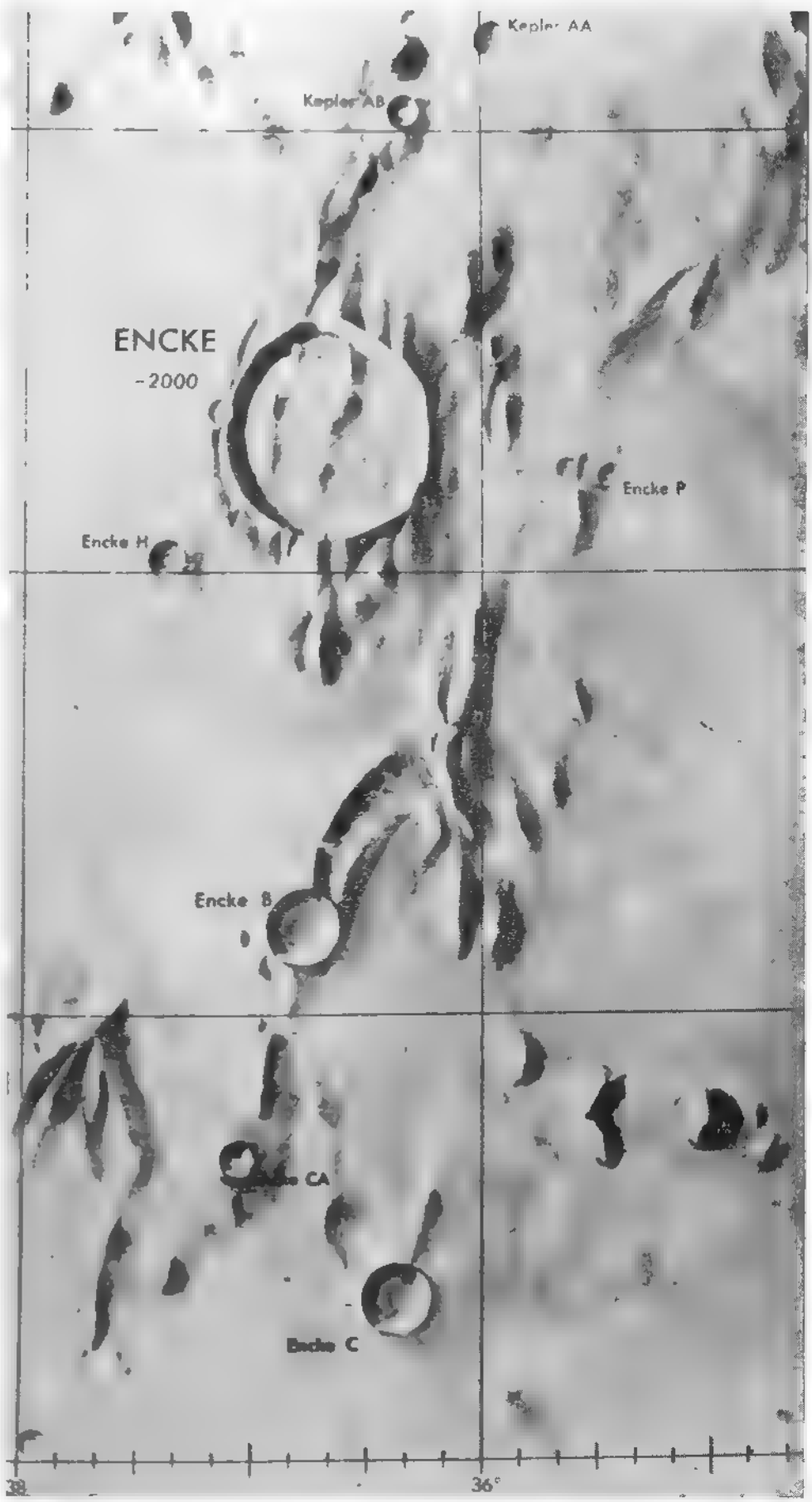
BRITAIN is providing the know-how for existing work, plus the optical and photographic equipment for a brand-new 40-inch telescope designed to take the finest-ever pictures of the Moon's surface.

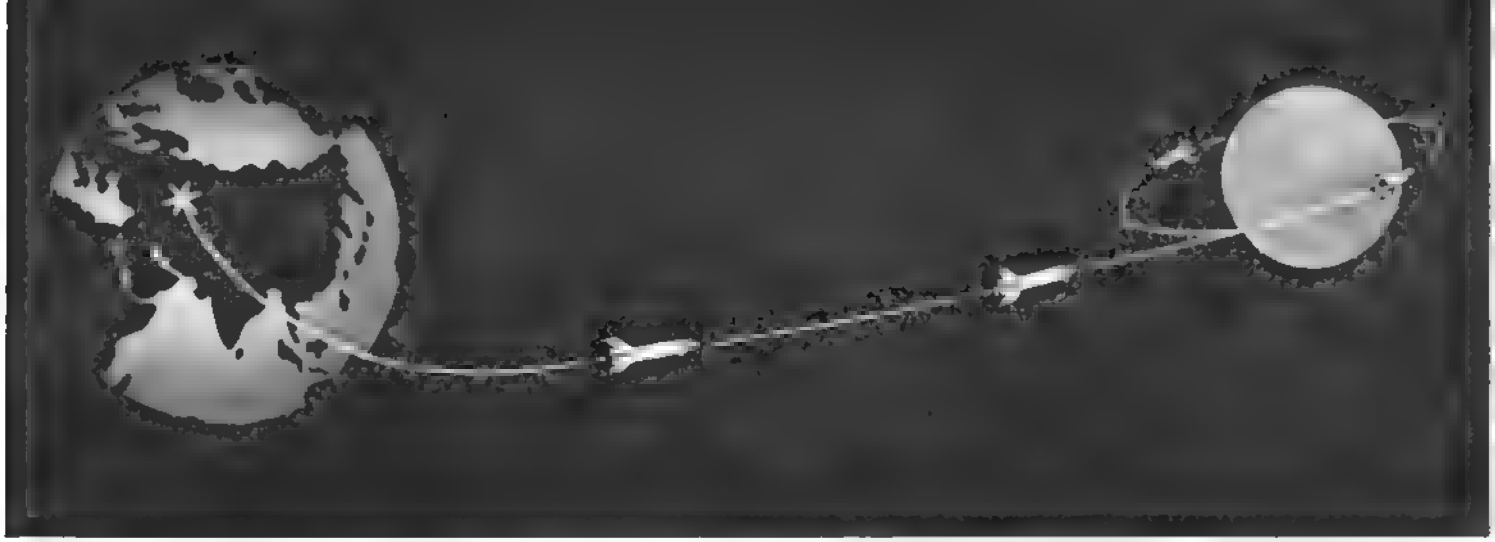
FRANCE is providing the telescope for the present work, plus the new telescope when it is ready, and the world's best Moon-mapping observatory—at the Pic-du-Midi, the 9,465-ft. high scientific station perched on the peak of the Pyrenees.

THE UNITED STATES is processing all the films, and producing the maps, at the Aerochart Centre of the United States Air Force, at St. Louis, Missouri.

The man behind the three-nation Moon-map scheme is silver-haired Professor Zdenek Kopal, 47, the Czech-born Head of the Department of Astronomy at Manchester University.

"There is no time to lose in completing the project," he says.





RUSSIA LOOKS AT THE MOON'S HIDDEN SIDE

O Moon ! When I look on thy beautiful face,
Careering along through the boundaries of Space,
The thought has quite frequently come to my mind
If ever I'll gaze on thy glorious behind.

A HOUSEMAID WROTE those words around the turn of the last century. She posed a good question, one that had been asked countless times by all sorts of people, from ordinary folk up to the cleverest scientists of the time.

For nobody knew what the reverse side of the Moon looked like.

It was not until the end of October, 1959, that the question could be answered with anything like certainty.

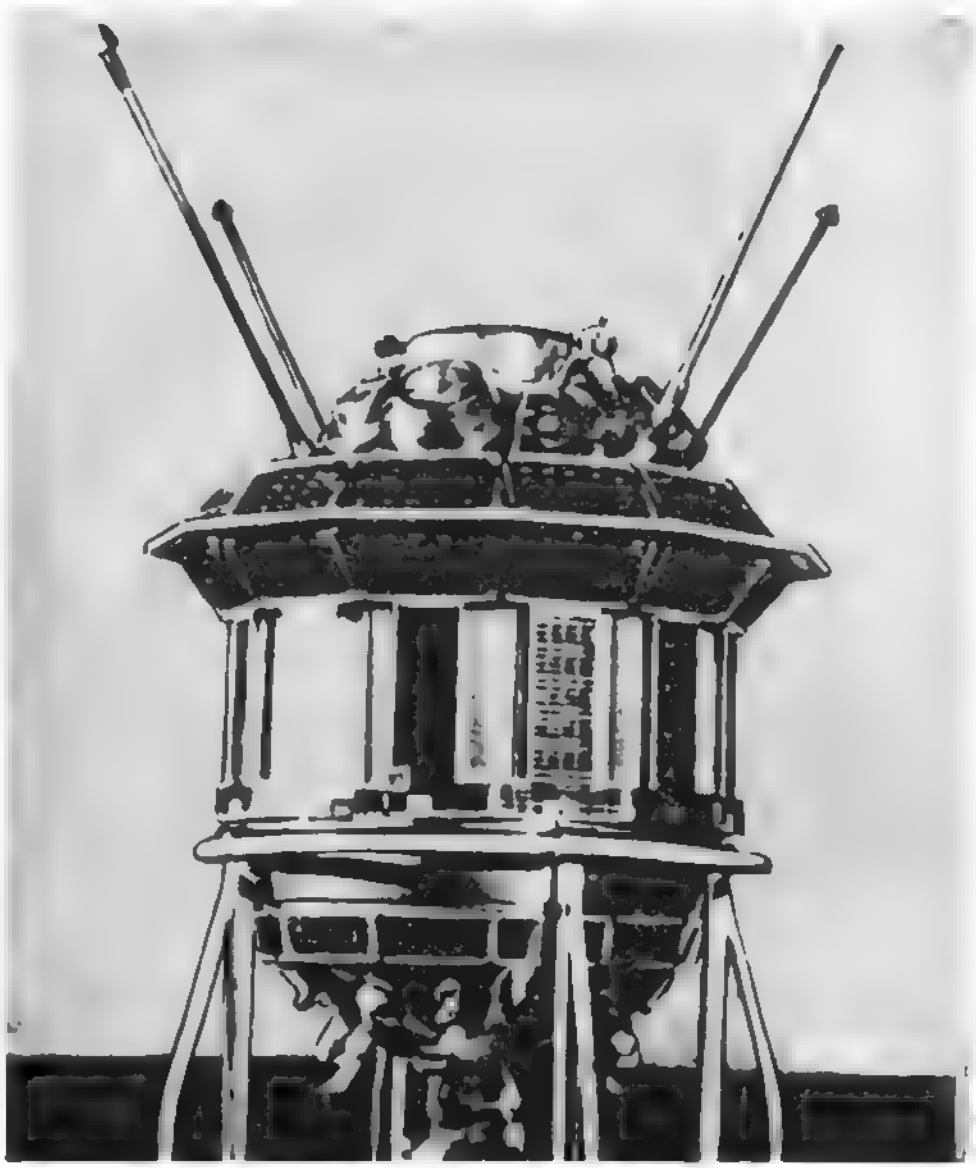
On October 4th, when the Space Age was just two years old, Soviet scientists blasted a mighty rocket away from the firing-pad.

The final stage alone weighed about a ton and a half. It contained a robot observatory weighing 613 lb., plus a power supply system weighing another 3 cwt.

The Russians called their robot observatory the Automatic Interplanetary Station. It had a complex and seemingly impossible mission : to orbit the Moon, photograph the far side, and send back to Earth by television the pictures that had been taken.

To many people, the Russian robot became the " Hey diddle diddle " Sputnik, because it jumped over the Moon to see what had never been seen before.

The picture right shows what the big robot looked like.



THE MOON NO MAN HAS SEEN

PLANNING THE BEHIND-THE-MOON shot was a tremendous achievement.

The Earth travels through space at around 66,000 m.p.h. The Moon travels round the Earth at 2,287 m.p.h.

The Russian robot observatory had to leave the launch-pad at a precise moment, and travel at just the right speed, to rendezvous with the Moon.

The distance out from the Moon had to be carefully calculated, too.

And equipment aboard the robot observatory had to be commanded, by radio signals from the Soviet Space Kremlin, to switch on and off at the right time in order to take the behind-the-Moon photographs and to transmit them by television to Earth.

It was rather like asking an expert rifleman to ride on a fairground roundabout at top speed, draw a bead on a passing bird, and fire one shot at it.

Making absolutely sure, as he did so, that he missed the bird—but got near enough to it for the bullet almost to ruffle its feathers.

The Soviet Moon-snapper left the launch-pad on October 4th, 1959.

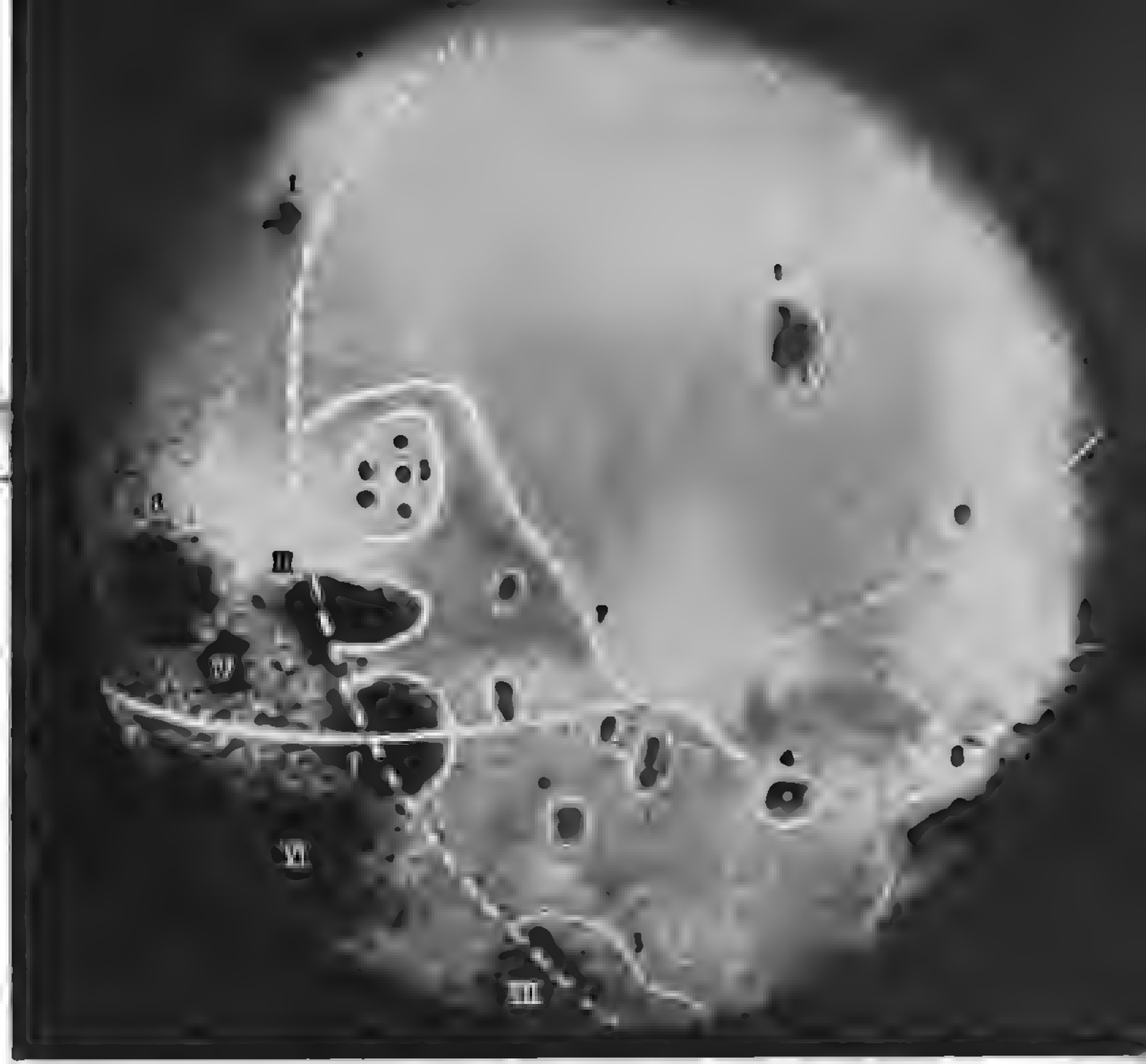
Four feet long and four feet in diameter, it passed within 4,900 miles of the centre of the Moon, approaching from the south. The pull of the Moon's gravity-field turned it behind the Moon, and, when it was about 40,000 miles out from the far side, the automatic equipment aboard was switched on by radio command.

That was at 3.30 a.m. on October 7th. Robot "eyes" sought out the Sun. Others "fixed" on the Moon. The robot observatory was then lined up in the right position to take full advantage of the fact that the Sun was lighting up about 70 per cent. of the far side of the Moon.

For 40 minutes, the cameras clicked. One took general pictures, the others more detailed shots. The films were developed and dried automatically.

On October 10th, the robot observatory was about 300,000 miles from the Earth. As it came back towards Earth, the pictures taken were transmitted by television, section by section.

From the hundreds of pictures they received, Soviet scientists pieced together the composite map, seen on the opposite page, of what the reverse side of the Moon looks like.



THIS IS IT—the side of the Moon that, until two years ago, had never been seen by man. The most vivid impression is that the Moon's face, like the human face, has many more distinguishing marks than its behind. The reverse side has not so many " seas," not so many craters.

The Russians were very careful, however, to have their robot cameras photograph sections of the Moon that could be seen from Earth, to check the accuracy of what they recorded of the far side.

In the picture above, the known and unknown areas are divided by the dotted line that curves downwards. The line across the Moon marks the Equator.

Left of the dotted line (marked in Roman numerals) are known features. They include the Humboldt Sea (I), the Sea of Crises (II), the Sea of Waves (IV), and the Sea of Fertility (VI).

Right of the line are the new features discovered. Those positively identified, after studying the hundreds of photographs, have a solid line round them.

Those needing further confirmation have either a "dashed" line or a "dotted" line round them.

The map shows the Moscow Sea (1), which is 200 miles across, and the Bay of Astronauts (2). It is an established fact that new astronomical discoveries are named by those who make them.

So the Russians christened a major mountain range (7) the Sovietsky Range. They called another main feature (8) The Sea of Dreams.

They honoured some of their great men, too. Tsiolkovski, the Russian " father " of space travel—he was born exactly 100 years before the Space Age dawned in 1957, and, in 1903, designed a space-ship with several features similar to the Vostok, in which Gagarin and Titov orbited the Earth—had a crater with a central peak (4) named after him.

Mikhail Lomonosov, an 18th-century Russian scientist in 1761 he discovered that Venus had an atmosphere—also had a crater with a central peak (5) named in his honour.

America's Plans to Survey the Moon

ROBOTS WILL BE used as front-line troops in the £3,000,000,000 United States campaign to put Americans on the Moon by the end of the 1960s.

And the first robots are ready for action. This year alone, the United States taxpayer provided £30,000,000 for their construction and further development.

Next year, when the first to-the-Moon robot blasts off from the Cape Canaveral launch-pad, another £40,000,000 will have been tacked on to the final bill.

Two main breeds of robot space-ship will be used for the initial unmanned assault on the Moon. One is called Ranger, the other Surveyor.

The Ranger space-craft is 11 ft. long and 5 ft. in diameter at its six-sided base. It looks like an oil prospecting rig, and weighs 675 lb. It contains 19,520 working electronic parts.

United States scientists who developed the space-craft have nicknamed it " The Bus." The reason ? It has been designed, like a bus, to carry a variety of scientific " passengers " of different shapes and weights.

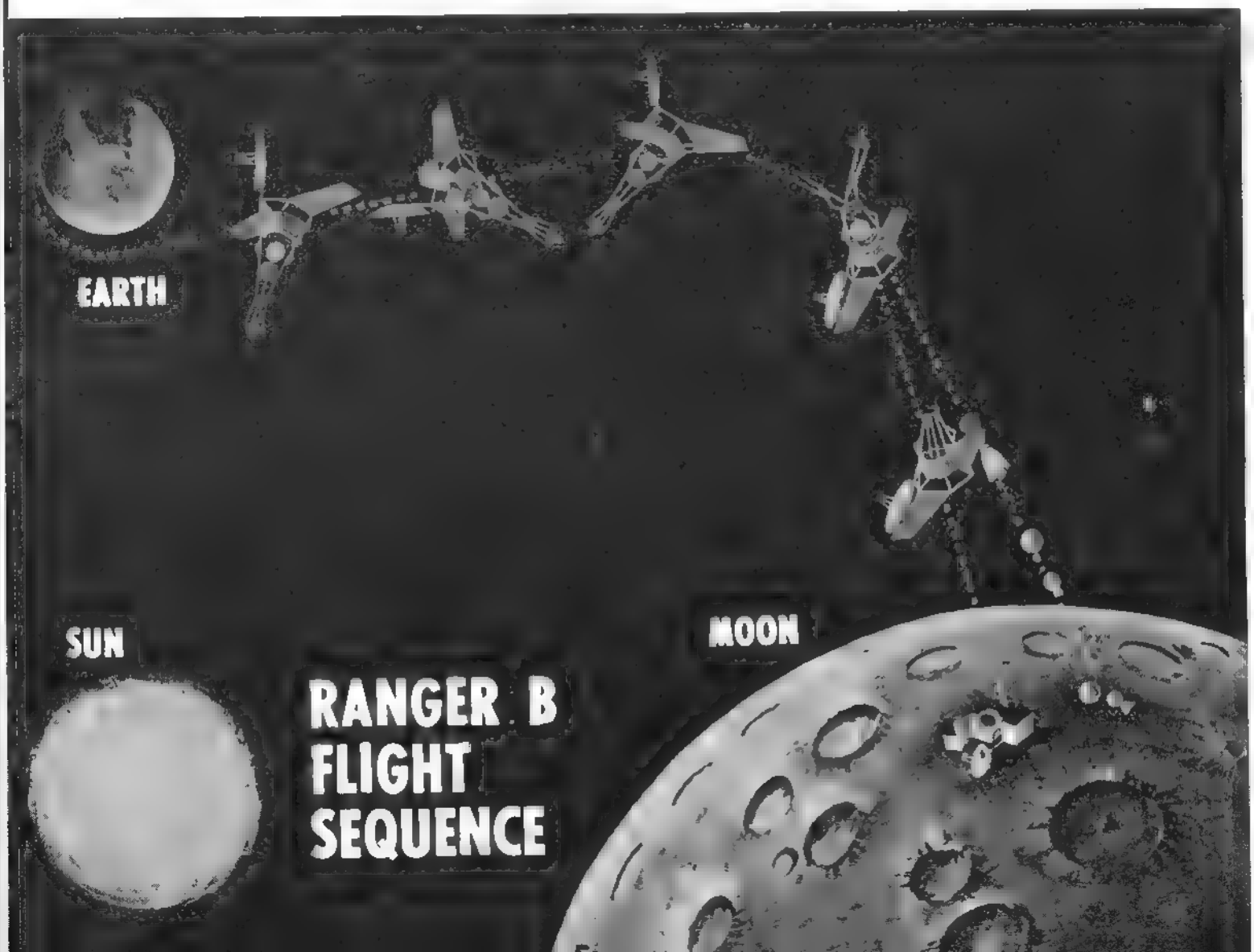
Each has a specific task to perform in advancing the date of lunar exploration by men

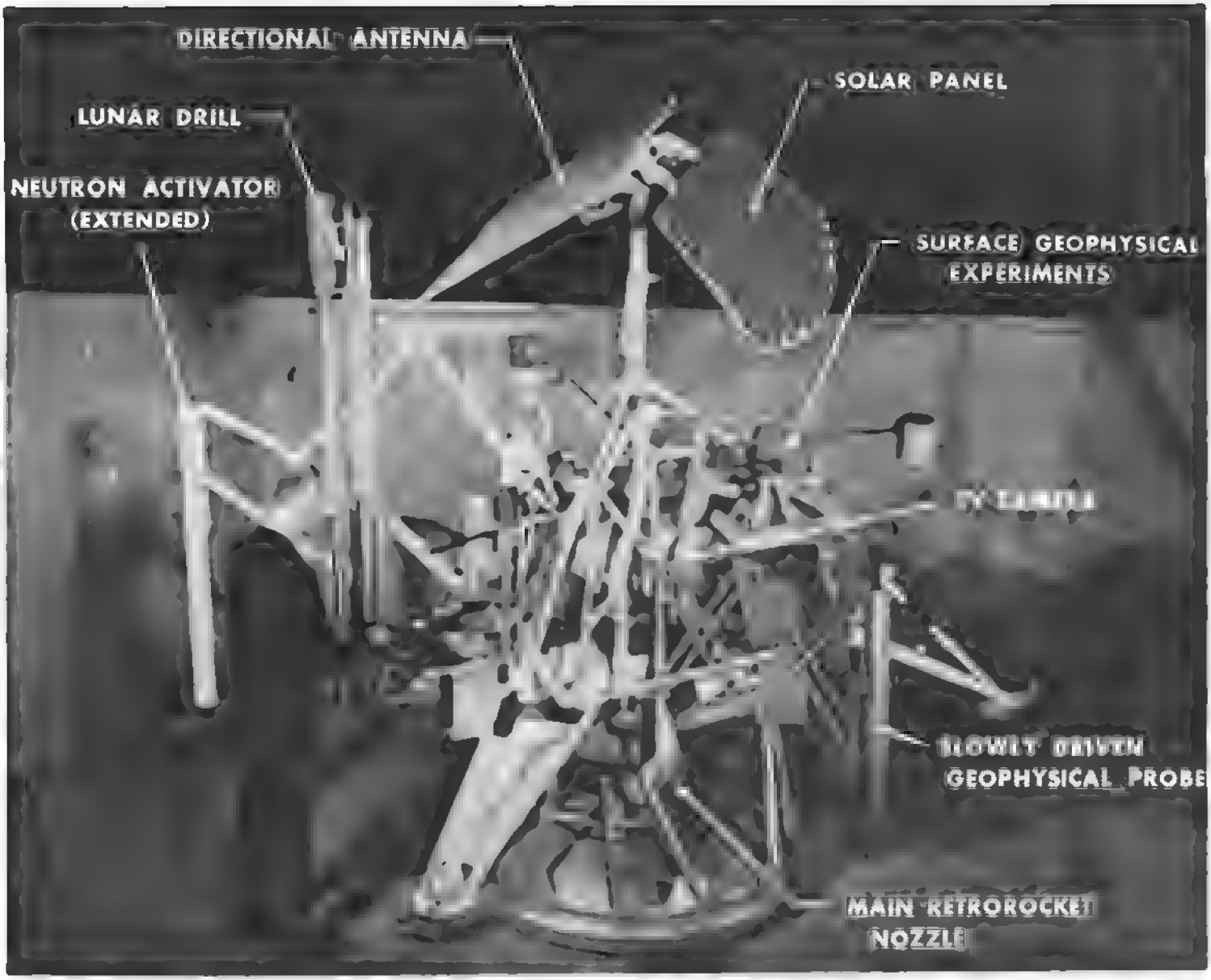
The rocket system to be used in the Ranger series consists of the 82-ft. long Atlas rocket with a 25-ft. long Agena second stage. The Ranger space-craft will ride in the nose of the Agena.

A tryout of the launching system, in which a Ranger–A space-craft was put into low orbit round the Earth, was carried out in August 1961. It worked well.

The space-craft made 111 orbits of the globe, and travelled almost 3,000,000 miles, before it burned up on re-entering the dense layers of the atmosphere.

Five Ranger–A shots are scheduled for the coming months, but the biggest moment in the Ranger programme will come in 1962.





Then, if all goes well, a Ranger B space-craft will crash-land on the Moon with a 300-lb. package of instruments. The artist's impression opposite shows how it will be done.

When Ranger B gets to within 2,000 miles of the Moon, TV cameras aboard will be switched on so that scientists on the ground can see how the mission is going.

As the space-craft nears the Moon, braking rockets will be fired to slow it down. The robot will crash on to the Moon at around 200 m.p.h., but a specially-designed shock-absorbing outer cover will protect the instruments aboard.

Main task assigned to Ranger–B is to measure the strength of Moonquakes (the equivalent, on the Moon, of earthquakes), and the shock of impact of meteorites, and to transmit these measurements back to Earth.

The Surveyor series of space-craft which will be sent to the Moon will have a much more sophisticated job to do.

Seven Surveyors in all will be built, and the first is due to set off on the 60-hour trip to the Moon in 1963.

The launch-vehicle for the Surveyor project will be the Centaur. This is a marriage of the tried-and-tested Atlas with a new rocket, Centaur, yet to be launched, but due to blast off almost any day now.

There is a picture of the joining of Centaur to Atlas on a following page.

The plan is to " soft-land " a 750-lb. capsule on the Moon at a speed of around 6 m.p.h., and United States scientists are confident that, when the blast-off time comes, everything will work perfectly.

The Surveyor space-craft, seen in the picture at the top of this page, will carry four TV cameras, one of them a colour camera. Three will look outwards from the Moon, the fourth downwards on to the Moon.

This camera will be the " eyes " for the rest of the scientific equipment aboard. This includes a special drill, to bore holes in the surface of the Moon to depths of from 18 inches to 5 ft.

Samples brought up by the drill will be put in front of the TV camera so that scientists on Earth can study them. The samples will then be analysed automatically, and the results of the analysis sent back to Earth.

Solar panels seen in the picture will convert the sun's rays into electricity to power the equipment, and the Surveyor robot is likely to go on working for a month, sending back constant information.

Most likely landing-point for the first Surveyor is in the region of Mare Imbrium, the 700-mile-diameter Sea of Showers.

After Surveyor will come Prospector. This robot will dig up a Moon-sample and bring it back to Earth for study.

The first version of Prospector will look like a giant beetle, and weigh between two and three tons. The flight-schedule is no more definite at the moment than somewhere in the 1966-1970 period.

United States scientists, however, are now thinking in terms of developing a much bigger Prospector for use in the 1970s.

It would serve as a kind of robot " handyman " for the construction of a manned base on the Moon.

ROBOTS ON THE MOON

The end of the journey: Surveyor about to land on the Moon

THE SPACE-TAXI

A SPACE-SHIP WITH wings, that can zip round the globe and then touch down anywhere with a five-miles-by-two-miles clear space—that's Dyna-Soar.

The United States space-taxi will be 92 feet long, and have a wingspan of 49 feet. It will weigh around ten tons.

The picture shows Dyna-Soar separating from the Titan II booster—this alone will stand over 100 ft. tall when it goes to the launch-pad—that will be used to blast the space-taxi on its first sub-orbital mission.

For a round-the-world trip, the Dyna-Soar space-taxi will ride the giant Saturn super-rocket, which will stand 200 ft. tall.

If all goes well, the first Dyna-Soar sub-orbital mission will take place in 1964. The first orbital shot should follow about a year later.

The United States is earmarking nearly £200,000,000 for the project. The first contracts have been awarded.

Dyna-Soar will be the first United States space-ship to provide the astronaut with the opportunity to return to Earth in easy stages, under control all the time, and land more or less where he likes.

He will do this by manoeuvring Dyna-Soar in a series of " skip-glides," in much the same way that a flat stone, thrown roughly parallel to the sea, can be made to hop and skip over the waves.

The Dyna-Soar pilot who wants to touch down in the United States will begin his homeward-bound manoeuvre when he is over Australia. He will then be 300 miles up.

About 100 miles above the Earth, he will hit the outer fringes of the atmosphere. The nose and wing-tips of his space-taxi will glow white-hot, the rest of the craft being heated up to a colour-range from bright orange to deep red.

When temperature gauges in the cockpit show that things are getting too hot for comfort and safety, the pilot will lift a little the nose of his Dyna-Soar.

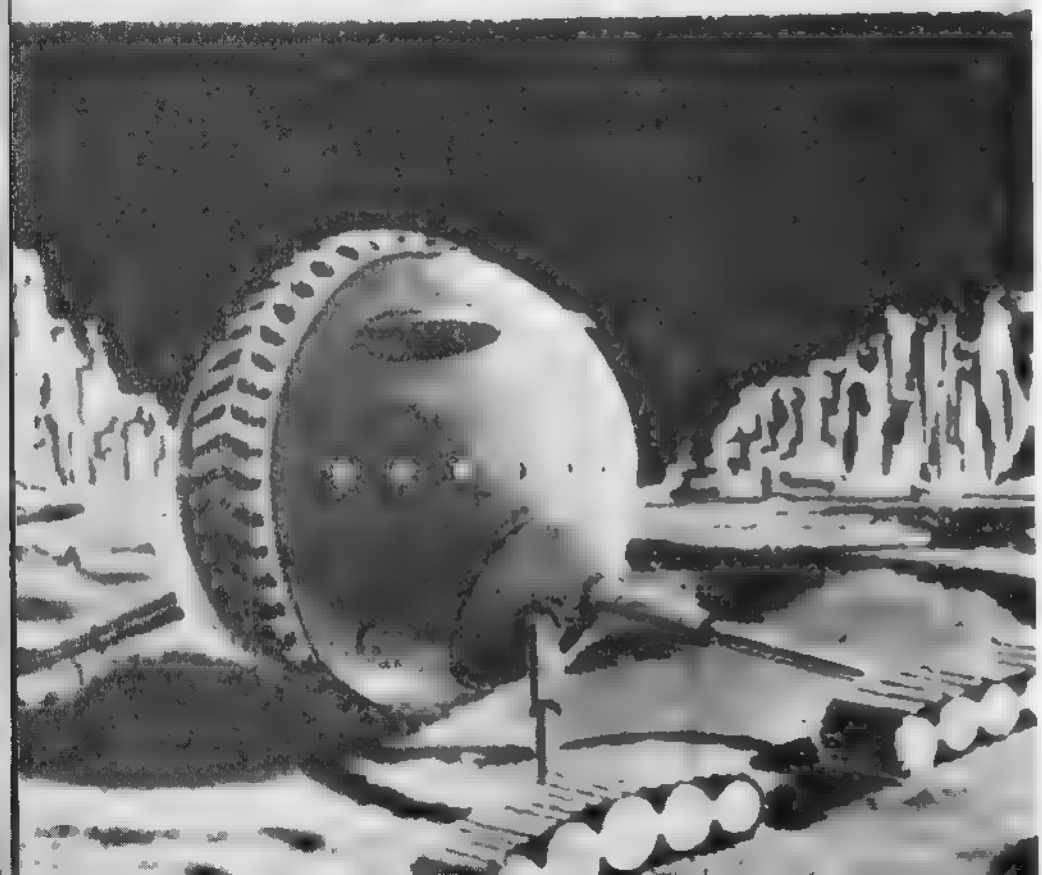
This will give the space-craft time to cool off.

Then, when the cockpit lights have returned to green again, he will drop down still lower into the atmosphere. Should the descent be too sharp, heating up the craft too much, all he will have to do to put things right will be to lift the nose once more for another cool-off period.

For the final stages of descent, the Dyna-Soar astronaut will fire braking rockets.

Then, with the touch-down base in sight—his cockpit will be provided with window-shutters that automatically flip back when the hottest part of the return journey is over—he will skid to a halt on special " skis " now being developed.

Tanks on the Moon



How will men move around on the Moon once they get there ?

The tank seems to offer a good answer to the problem.

It can be made big enough to contain all the life-support systems—air, food, water, shelter—that man will need on the Moon.

It can be made tough enough to withstand the shock of impact, and still crawl around afterwards.

It can be kept reasonably small enough to pack inside the giant rockets—dwarfing anything yet seen on the launching-pad—that will be needed for a lunar exploration by men.

United States and Soviet space scientists have long shared an enthusiasm for the tank as the ideal Moon vehicle.

Professor Yuri Khlebtsevich, Chairman of the Soviet Technical Committee on Radio-Television Guidance of Rockets, was one of the first in the field with the idea of a Moon-tank.

His " tankette-laboratory," as he called it, is an all-robot affair. But his design is so detailed that his machine will be able to replace any parts that wear out—under radio command from the Earth—by drawing a new part from a stock it will carry.

Recently, United States scientists, attending a meeting of the American Rocket Society, unveiled some of the designs upon which they have been working.

Their Moon-tanks were designed with men, not robots, in mind.

Each can carry a crew of three, which psychologists think is the ideal make-up of a manned mission to the Moon.

The Moon-tank shown in the top picture has a one-man Moon runabout attached to it.

The runabout leaves the mother-tank in the same way that the mother-tank is designed to leave the space-ship—down a collapsible ramp.

It is provided with pincer-like arms. These will be used to collect, and carry back to the mother-tank, rocks, and other Moon specimens, for detailed study.

The ball-tank, in the bottom picture, looks like a monster from the uncharted depths of the ocean.

The slender-looking legs by which it is linked to the tractor-like feet are powerful enough, however, to enable the ball-tank to move over rough and uneven Moon-terrain.

And there is room inside for a well-equipped laboratory-workshop, as well as for a galley, sleeping quarters, and a small lounge where the Moon-men can relax.

THE 60-HOUR JOURNEY from the Earth is almost over.

The 300-lb. instrument-laden package has just been separated from the space-craft that brought it from Cape Canaveral.

Target Moon is dead ahead. Moonfall is minutes away.

A radio pulse from the departing space-ship fires the braking rocket. This slows down the rate at which the precious cargo of robots falls towards the Moon.

They will hit the lunar surface with about twice the force that a running man collides with a brick wall.

Minutes after that happens, the robots will be ejected from the capsule, to start their task of gathering facts about lunar life.

The survival of men on the Moon hinges on the successful landing, on the lunar surface, of robots like this.

MEN ON THE MOON

TAKE FOUR GIANT rockets. Build them up, like a child with a pile of bricks, one on top of the next.

Start with the biggest. It is 80 feet tall, 50 feet in diameter. When you have finished, the tip of the topmost rocket will be 314 feet above the ground. Crown the assembly with a three-decker spaceship. It is 40 feet long, 12 feet wide, and it weighs 70 tons.

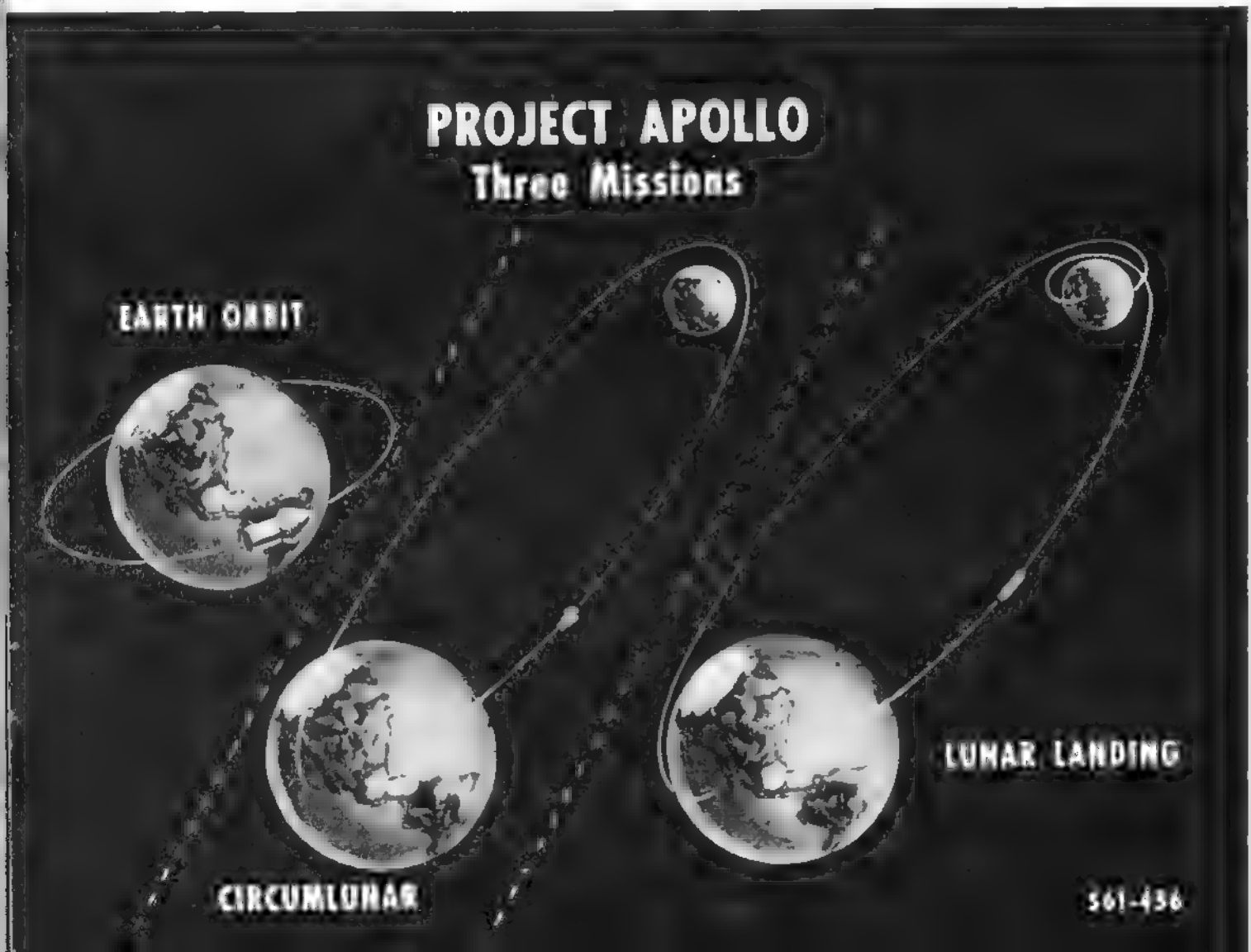
The rocket-train now stands 354 feet high. Nearly double the height of Nelson's Column (185 ft. to the top of Nelson's hat). Almost as tall as the golden cross (365 ft. above the ground) that crowns St. Paul's Cathedral.

The rocket-train weighs well over 2,000 tons. The heaviest steam locomotive on British Railways today weighs, with tender, 167 tons.

THE ROCKET-TRAIN IS NOVA. IT IS BEING DEVELOPED IN THE UNITED STATES NOW.

WITH ONE AIM IN MIND: PROJECT APOLLO. TASK—TO TAKE THREE MEN TO THE MOON AND BRING THEM SAFELY HOME AGAIN.

With luck, they should make the trip by 1967. Definitely, United States scientists insist, by 1969.



This is Saturn—nearly ready for the launch-pad

Nova is the ultimate in chemical rockets. Nothing bigger is ever likely to be seen. The Moon is the last stop on the space-line that can be served by such rockets.

The successor to Nova is already under early development.

After Nova comes Rover, the nuclear-powered rocket project. Using the energy locked up in the atom, the nuclear rocket alone can enable man to venture beyond the Moon in his quest to bring the planets, too, under human domination.

Much has to be done before America's first manned rocket blasts off to the Moon at the end of the Sixties. The groundwork is well laid. To pave the way for their journey to the Moon, United States astronauts must first :

1. Spend weeks orbiting the Earth, making scientific measurements, and accustoming themselves to the strangeness and loneliness of space ;

2. Make voyages round the Moon, to check the information about it gleaned by the robots that were sent to pave the way for the first human footfall on the lunar surface.

THE SATURN PROJECT is the first step in the big United States to-the-Moon programme for men. Until now, the Americans have lacked the mighty rocket-boosters at the disposal of Soviet scientists —the rocket " muscles " that enabled the Russians to grasp, then keep, the lead in the great Space Race.

Saturn is the Americans' answer to this problem. The tail section of this mightiest-yet of United States rockets is 22 feet in diameter—more than double the width of the Atlas rocket that has borne the main burden of their space-effort so far.

When Saturn goes to the firing-pad for its first big test, it will stand 200 feet high, and weigh more than 500 tons.

The eight rockets in the tail-section will provide a blast-off " kick " of 1,500,000 lb. of thrust, almost five times that of Atlas.

In the first Saturn test, only the tail-section will be fired " live." The upper stages will be dummies.

But by 1963, the upper stages, too, will be " live." Their firing will be the rehearsal for the first Saturn contribution to the men-on-the-Moon programme.

This will be the placing in orbit, in 1964, of a ten-ton Apollo space-ship. The three men aboard will orbit the Earth 300 miles up, and spend at least a fortnight in orbit.

And in 1966, when the C–2 and C–3 versions of Saturn should be ready, their even more powerful engines will make Cape Canaveral tremble as they blast off a three-man Apollo space-craft for a voyage round the Moon.

The Saturn rockets are so much bigger than anything else the Americans possess that special facilities have had to be built for them.

They were completed, at Cape Canaveral, on June 5th, 1961, and the bill for the new launch-complex—Complex 34, it is called —came to nearly £15,000,000.

The servicing tower for the Saturn vehicles stands 310 feet high, and weighs close on 3,000 tons.

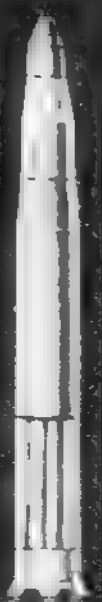
THE NOVA PROJECT is the culmination of America's men-on-the-Moon hopes. There are several versions of Nova on the drawing-boards at the moment.

The biggest is a six-stage monster that will weigh around 5,000 tons and stand 410 feet tall at blast-off.

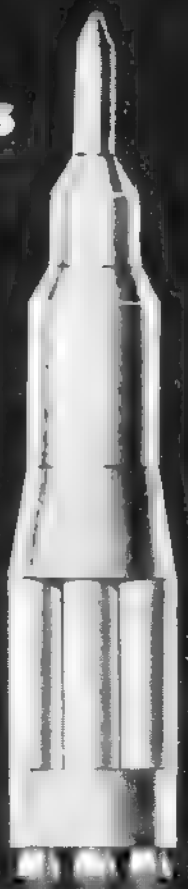
This will be used to establish the first lunar base—after the three astronauts, riding a smaller, four-stage version of Nova, have landed on the Moon, carried out six-day surveys there, and returned to Earth with the facts.

PROJECT APOLLO
Three Launch Vehicles

EARTH ORBIT
SATURN C-1



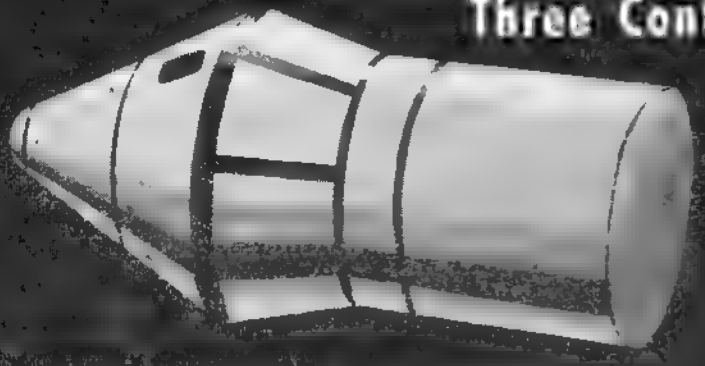
CIRCUMLUNAR
SATURN C-2



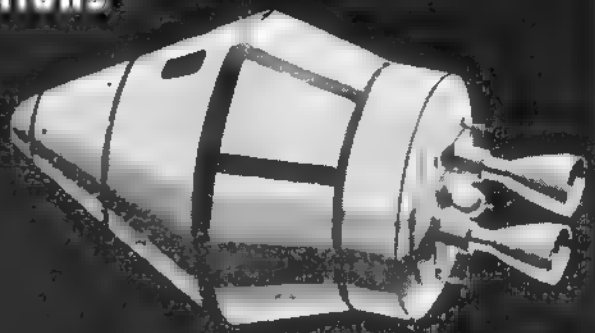
LUNAR LANDING
NOVA

S61-459

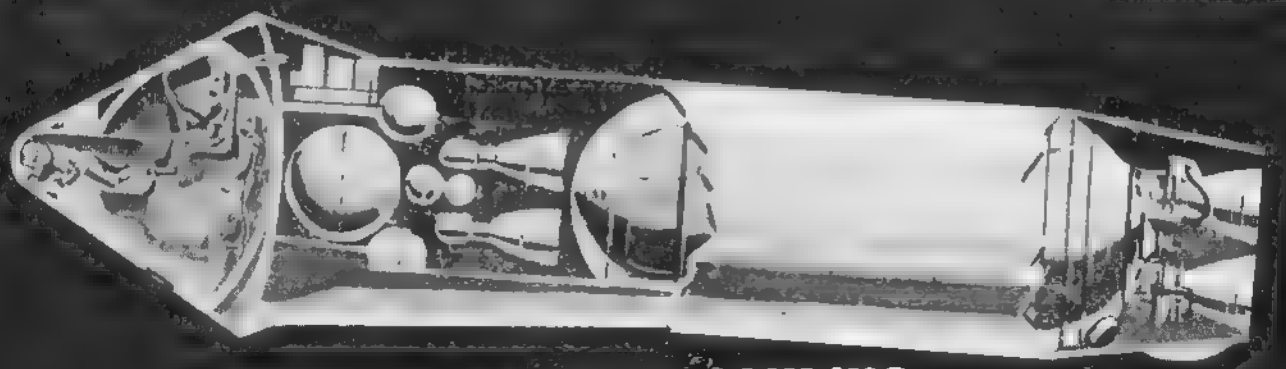
PROJECT APOLLO
Three Configurations



EARTH ORBIT



CIRCUMLUNAR



LUNAR LANDING

S61-458

Nova's main booster will make that of Saturn seem as small, by comparison, as Atlas now seems in relation to Saturn.

The clustering of eight F 1 rocket motors, each developing as much " kick " as Saturn's eight engines harnessed together, will yield 12,000,000 lbs. of thrust.

And the first F-1 engine was successfully tested at the end of August, 1961.

THE APOLLO PROJECT is the name United States scientists picked for their plan to design and build a series of three-man space-ships.

Apollo-A will be used to put the three men into orbit round the Earth, and keep them there for a fortnight. This version will weigh ten tons.

Apollo-B will be the space-ship used for the round-the-Moon mission. This, too, will weigh around the ten-ton mark.

Apollo-C, for the lunar landing-and-return mission, will be much bigger and heavier. It will be 40 feet long, 12 feet wide, and weigh 70 tons.

It needs to be so big because the first men to the Moon will have to take with them all their air, food, water and recreational facilities for at least a 14-day stay away from the Earth—plus enough fuel to enable them to reach a speed of over 5,000 m.p.h. on the return journey, to escape the Moon's gravity-clutch.

The Apollo-C space-ship will consist of three sections.

THE TOP SECTION will contain the Command Post, nerve-centre of the space-ship. Here will be the flight-deck, with all the controls, and the instruments for communication and navigation.

THE MIDDLE SECTION will house the space-hotel. Here, the crew will eat, sleep, and pass the time, during the 60-hour outward and return journeys.

THE BOTTOM SECTION will house the space-ship's power units, and rocket-fuel tanks. Rockets will have to be fired to correct course, on the outward and return trips, to slow the space-ship down for the descent to the Moon's surface, and to blast-off for the return trip.

And this is how the first manned voyage to the Moon is likely to develop.

The three-man crew will ride in a lift to the top of the 400-ft. Nova service tower.

A Moonport site 50 miles south of Corpus Christi is the spot most favoured by the National Aeronautics and Space Administration, though Cape Canaveral will have a big role to play in earlier Apollo soundings for round-the-Earth and round-the-Moon missions.

The Moon-men will be allowed to take 35 lbs. of luggage with them, according to present estimates, but this must include their space-suits.

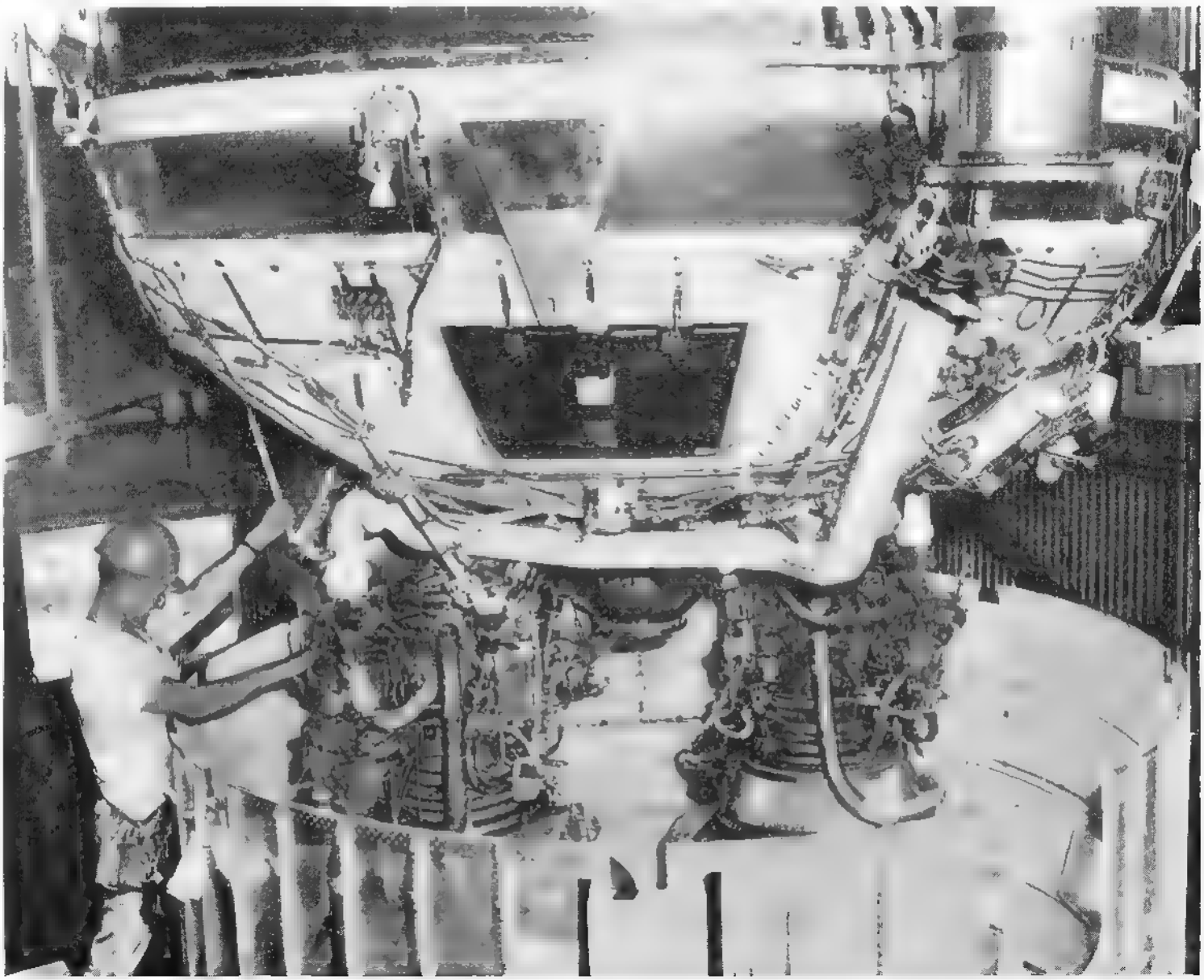
Once in the Command Post, the pilot will take his seat at the left side of the control panel. The co-pilot will be on his right, and the engineer behind him.

All three men will be qualified in at least one branch of science, such as geology, biology, medicine, or astronomy, in addition to their own speciality

After blast-off, Apollo will move into a " parking orbit " 125 miles above the Earth, while the crew go carefully through every item on a long check-list.

If everything is found to be working

Mating of Centaur upper-stage to the Atlas. Mission: Instruments to the Moon by 1963



MEN on the MOON

First test of the F–1

perfectly, the pilot will order : " On to the Moon." If not, he will take Apollo back to base.

The decision to proceed having been taken, the space-ship will speed up to 25,000 m.p.h. Checks will be made to make sure that it is dead on-course. Then the crew can relax.

They will take it in turns to go back to the space-hotel, but they will not be able to smoke. Two men will always be on duty. The third man will have to prepare his own meals. Food will consist of concentrated diets squeezed out of tooth-paste tubes. A small oven will enable the food to be warmed.

The day will be divided into three periods—ten hours work, eight hours sleep, six hours relaxation. Books and games will be carried, but the main recreation will be looking out of the port-hole at the Earth, growing smaller, and the Moon, growing bigger.

Two days and 200,000 miles from base, the first braking rockets will be fired. The pilot will consult his Moon-landing charts, prepared on the round-the-Moon voyages, and pick the best.

This will probably be (according to present knowledge) on the Mare Imbrium, the Sea of Showers. Sixty hours after blast-off, the first Americans should step out of their Apollo space-ship on to the Moon . . . watched by millions back at home, glued to their television screens.

The six days and nights ahead of the Moon-men will be the most crowded of their lives. Not a second of their time must be wasted.

Their six-hour relaxation period, and their eight-hour sleep ration, will be halved. Getting these three men on the Moon will have cost the United States taxpayer (by 1961 standards) £3,000,000,000.

They will have to earn their keep the hard way.

Months before they left the Earth, their timetable of activity on the Moon had been mapped out almost to the second.

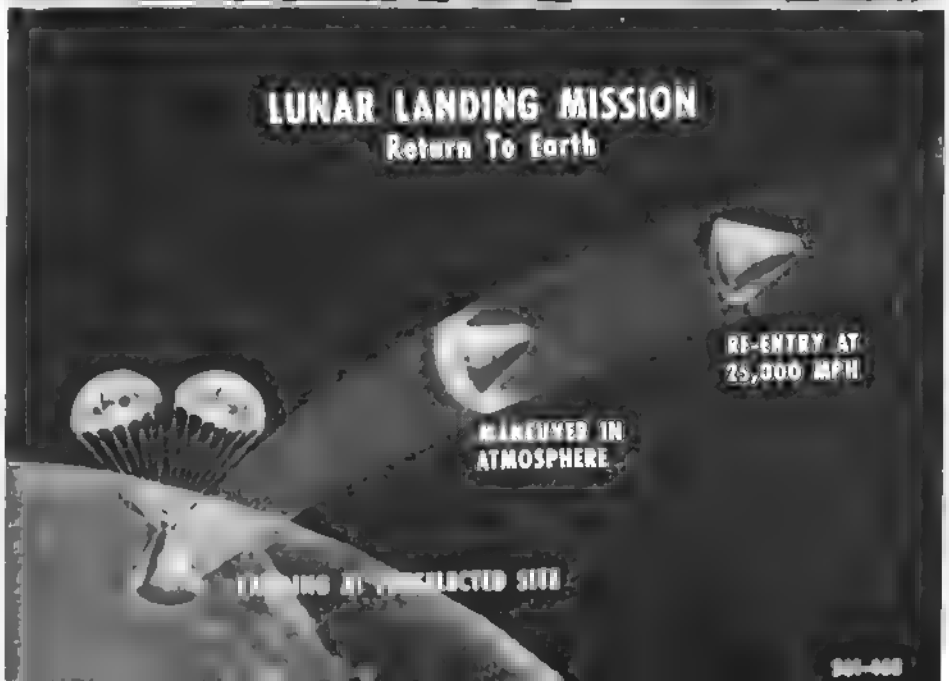
One of the first tasks set them was to prospect the Moon for minerals, seek signs of plant life, and drill the lunar crust to discover whether or not there are underground water resources that could be tapped for use by later lunar explorers.

Also high on the priority list : making measurements of the cosmic-ray intensities on the Moon, and photographing the Universe as seen from the Moon.

Taking pictures of the Earth will be a " must," too. So will be the task of reporting back to the Earth-base.

At the end of their six-day stay, the Moon-men will begin the complex task of checking their space-ship for the return trip.

This time, there will be no moving into a " parking orbit " for the check procedure. Once the Apollo space-craft is known to be in perfect condition, the blast-off button will be pressed, and the order given : Next stop Home.



Britain's Space Role

It is odd that Manchester, which most people regard as Britain's rain-and-fog capital, should also be the centre of the nation's space research effort. Strange—but true.

At Jodrell Bank, twenty miles from the centre of the city, the giant radio telescope of Manchester University stands like a colossal electric bowl-fire dumped down among lush green fields.

In summertime, the big radio " eye " is knee-deep in contented cows.

But Summer and Winter, it peers to the fringes of the Universe with the same ease that it pinpoints Soviet Sputniks crash-landing on the Moon, or keeps contact with United States Pioneer probes voyaging along the space-road to the planets

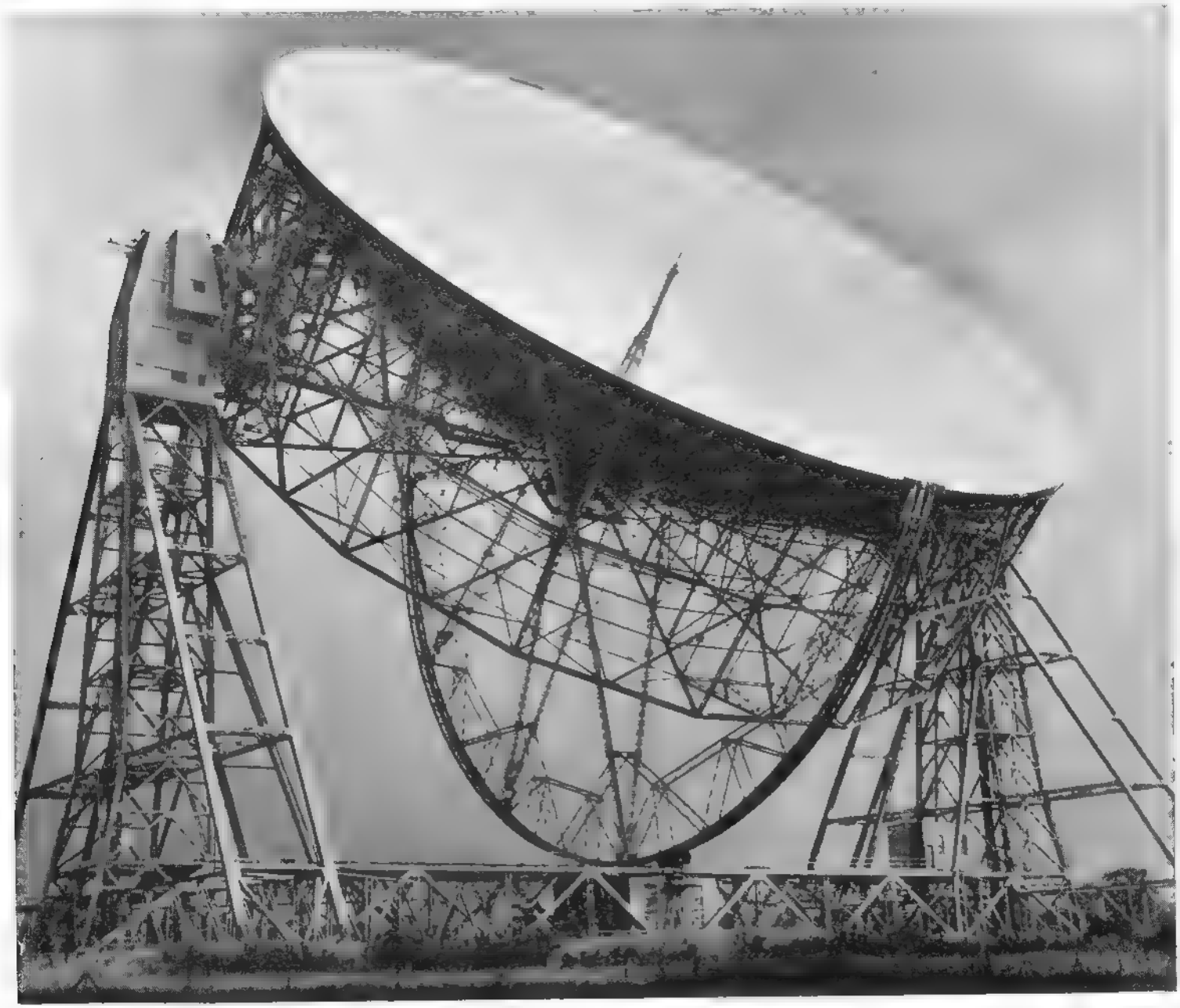
Jodrell's great bowl is 250 feet in diameter. Inside it, ten thousand people could stand. The giant telescope weighs 2,000 tons.

It is a tribute to the far-sightedness, and to the ruthless energy, of the man who directs it. He is Professor Sir Bernard Lovell. His knighthood, for his space research work, delighted everybody in Britain who had a spark of adventure in their hearts.

The Russians and the Americans alike have long coveted Jodrell Bank's super " eye."

It has been at the service of both Powers since the Space Age dawned. Both countries are now close to outstripping, with new radio " eyes " they are building for themselves, what Jodrell Bank can offer.

But while Sir Bernard—" Prof " to everybody—remains in command, the world's spacemen will still turn to Manchester for that little bit of something the others haven't got.



THE BRITISH SPUTNIK

SOMETIME IN 1962, the Union Jack will join the Hammer and Sickle and the Stars and Stripes out in space.

The launching of Britain's first satellite will take place from the main United States space-base at Cape Canaveral, Florida.

As you can see from the picture on the opposite page, Britain's satellite, when it goes into orbit, will look rather like a portable electric drill with paddles attached.

Before final assembly, the main parts will be gold-plated, then painted all-white, to help keep even temperatures inside.

Until the beginning of October 1961, the idea was that Britain's Sputnik, called U.K. 1, should ride into space in the nose of a four-decker United States Scout rocket.

But Scout, which American spacemen call "the poor man's Sputnik-launcher," ran into trouble. And the National Aeronautics and Space Administration, which runs America's space programme, offered Britain another rocket combination.

This is Thor-Delta, a bigger and more reliable rocket assembly. Switching to Thor-Delta will mean that Britain's "moon" will rise later than was planned —probably in the summer of 1962 instead of in the early part of the year—but it will have a better chance to shine.

A second British satellite is to be given a free ride into space by the Americans. This one, U.K. 2, will not be ready for blast-off until late 1963 or early 1964.

Many British scientists think that the Government has made a mistake in taking the easy way into space.

They say Britain should have gone ahead, with the Commonwealth, in organising an all-out, all-our-own-work space programme.

This would have used the big rocket range at Woomera, which Britain shares with Australia, as the launching-base.

And it would use Britain's big Bluestreak rocket, developed and then abandoned as an H-bomb carrier, as the booster to put a much bigger and more ambitious satellite into orbit than the one that will ride to space in the United States Thor-Delta rocket.

The development of Bluestreak has already cost the British taxpayer around £90,000,000. So far, the only journey that the rocket has made is by road—to the Farnborough Air Show in 1961.

Eight of Britain's most go-ahead firms, however, each a leader in a field of technology, have grouped into the British Space Development Corporation.

They want to develop an all-British space project based on Bluestreak. The firms include Rolls-Royce, de Havillands, makers of the big rocket, Associated Tele-Vision, Decca, and A.E.I.

Topped by Black Knight, the highly successful all-British research rocket built on the Isle of Wight, and by an all-British third stage, Bluestreak, the experts say, could put a one-ton satellite into orbit round the globe.

This could pave the way for a whole fleet of British communications satellites, which would enable this country to cash in on a lucrative new business venture.

Here is a breakdown-by-numbers of the British Sputnik that will go into orbit with a boost from the Americans.

1. The two discs on the tail will be used to make measurements of the densities of atom radiation in space.

2. The disc at the other end, in the protruding nose, contains equipment to measure temperatures in space.

3. The four paddles contain hundreds of cells which convert sunlight into electricity. This powers the radio transmitters that send back to Earth the information that the other instruments have collected.

4. The four spikes are the transmitting aerials.

5. The globe, four inches in diameter, contains equipment to record cosmic radiation—the power of "bullets" of tremendous energy that travel through space.

6. The main body of the satellite. This is 23 inches in diameter and 10 inches deep. It houses scientific equipment for other experiments in space. These include measurements, not yet attempted by either United States or Soviet scientists, of radiation from the Sun.

The plan is to put the British satellite into an egg-shaped orbit. This will take it 600 miles from the Earth at the farthest point, and bring it to within 200 miles of the Earth at the nearest.

The lifetime of the satellite will be around a year, but at the end of the year, the radio "voice" aboard will be silenced.

The British "moon" will pass over this country, on a track taking it from Northern Scotland to Southern England, during some of the orbits it makes.

One of the main tasks that will be carried out by Britain's second Sputnik, due up in a couple of years, will be the study of the nature and speed of micrometeorites.

These are minute particles, rather like tiny grains of sand, that travel through space at vast speeds—up to 100,000 m.p.h., it is estimated.

Some scientists call these micrometeorites "space-dust." They will pose a problem for men who ride in space-ships. If a space-ship ran through a space-dust cloud, the tiny particles could punch holes in the hull and cause the space-ship to spring a leak.

The No. 2 United Kingdom Sputnik will use special equipment, made in an attic in Bolton, Lancs, to tackle this space-dust problem.

As the satellite travels through space, the micrometeorites will punch holes in thin sheets of foil. Sunlight will then be passed through the holes so that their size can be checked against a "reference map" of hole-sizes.

This "reference map" is made in Bolton by Mr. Gordon Smethurst. He uses a secret process to make tiny holes that are used as standards of measurement in scientific laboratories all over the world.

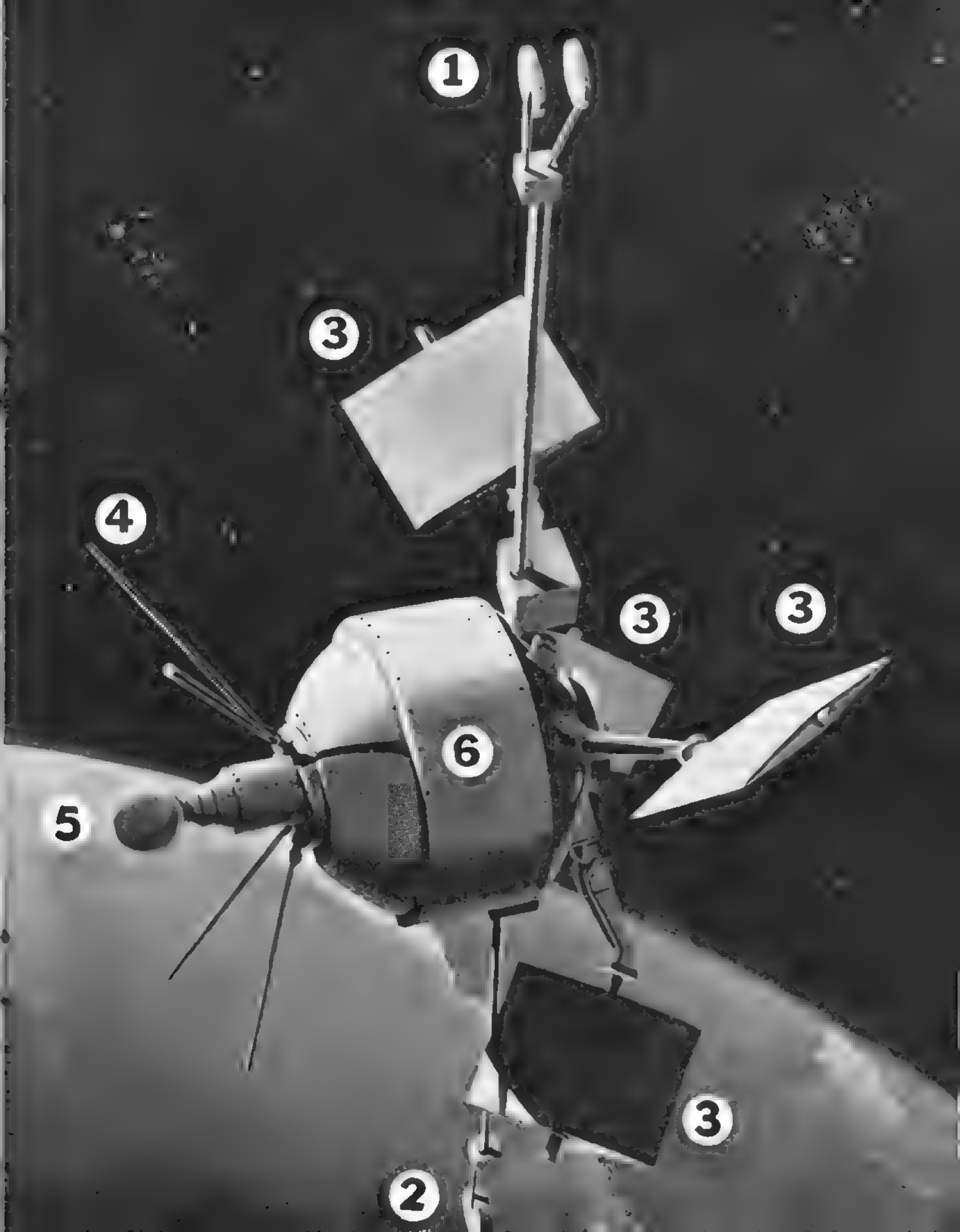
They go down in size to holes as small as 1-20,000th of an inch.

Electronic "eyes" inside the satellite will compare the size of the holes made by the micrometeorites with the holes in the "reference map."

This information will be sent back to the ground by radio, using a kind of scientific code-message, with a different signal for each size.

Also to be carried in Britain's Sputnik 2 will be equipment to detect radio waves which cannot normally penetrate to the surface of the Earth.

The United States is to put a third rocket at Britain's disposal for use a as Sputnik-launcher. No decision has been made yet about what experiments should be carried in it.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How the Satellites Could Work for Us

So MANY PEOPLE want to speak to each other that existing communications channels can hardly cope with the traffic.

As fast as new radio networks and new submarine cables are opened up, demand exceeds supply.

Scientists and engineers are now turning to the Space Post Office as the means of overcoming this communications problem.

Satellites, orbiting the globe like robot messenger boys, will soon be taking over some of the routine job of transmitting messages.

Britain is getting into the Space Post Office traffic. In 1962, a series of experiments will be carried out in conjunction with the United States to find out just how well the method will work in handling Transatlantic traffic.

Some satellites merely act as reflectors, bouncing messages sent from one part of the world back to another part.

Others have a more active role. They pick up messages as they pass over one country, and send them down again when they reach another country over which they travel.

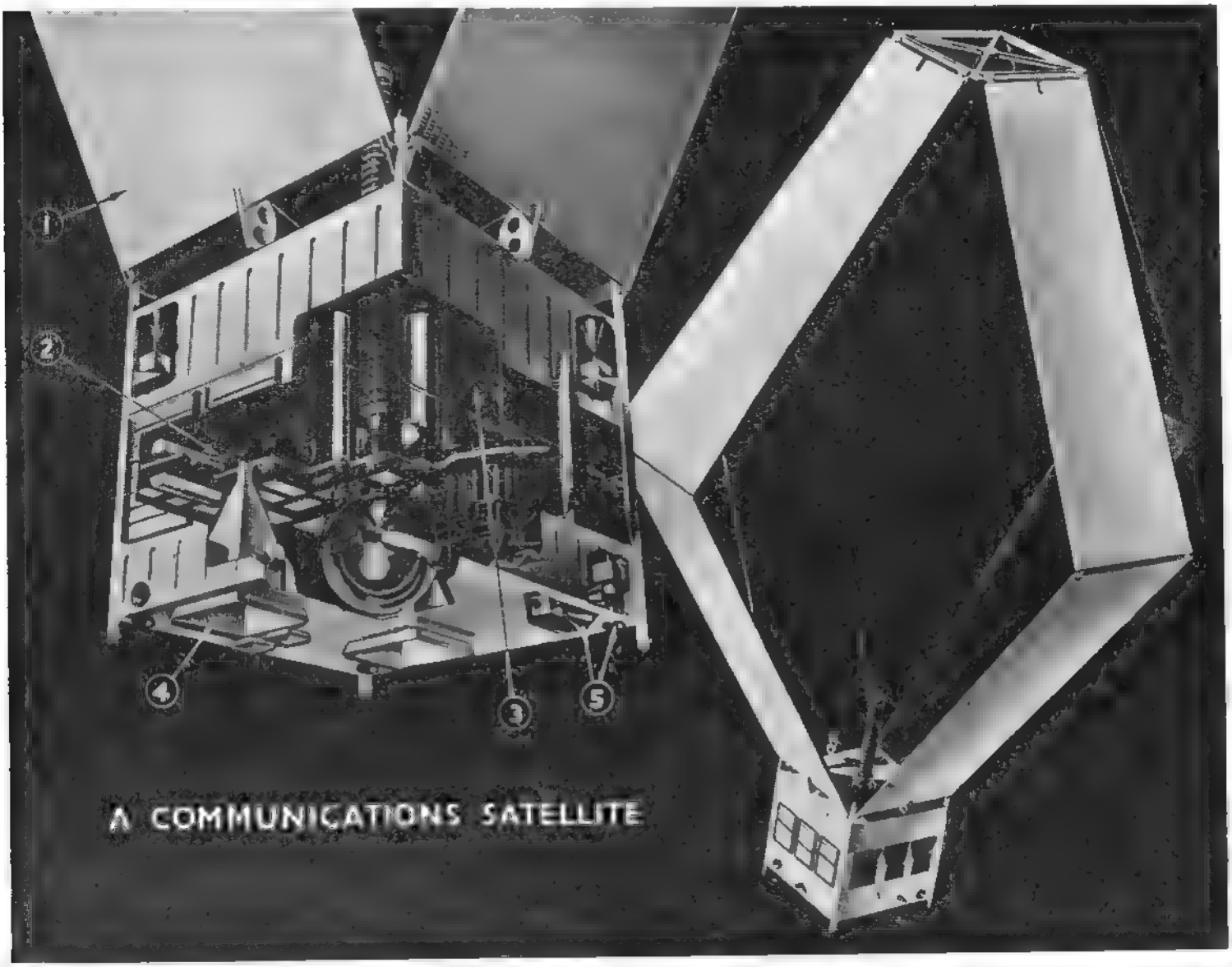
They record the messages on magnetic tape, store them, and play them back when commanded to do so.

They can also handle phone calls. You should be able to phone up the United States for sixpence a minute via space, the experts claim.

And they can also handle world-wide TV, too—giving you, as they happen, the moments of history made in other lands.

The picture below shows what a British Space Post Office would look like, and how it would work.

The numbers show the position of the solar cells (1) that would convert sunlight into electricity, the housing for the radio equipment (2) and the batteries (3), the aerials (4) and the stabilisation nozzles (5).



A COMMUNICATIONS SATELLITE

A SPACE STATION, like the one seen in the picture above, could be the next trump-card to be played by Soviet scientists.

In September 1960, speaking at Helsinki, Finland, Soviet Premier Nikita Krushchev said Russian experts were at work on a "space train."

It would weigh 60 tons, he added. The heaviest object blasted into space so far is the 6½-ton Sputnik, launched by the Russians on February 12th, 1961, and from which they launched their robot observatory to Venus.

Another hint about Soviet space intentions was given by Major Titov, the Russian cosmonaut who spent more than 25 hours in space in August 1961.

In a speech he made a month after his safe return, he said Soviet scientists would launch a space station "soon."

It could serve many useful purposes. Equipped with television cameras linked to a telescope, a space station could enable astronomers on Earth to have, by remote control, their first true look at what the Universe is really like.

Earthbound astronomy is rather like studying the stars through a dirty window pane.

Even a small telescope in space could yield more knowledge, linked to TV cameras and operated by remote control, than a very big telescope on the ground

The future for the space station is bright. For years, scientists have been designing MANNED space stations. A leading United States expert, Dr. Willy Ley, has designed one to house 80 men.

Rotating slowly, his space station would provide synthetic gravity for the occupants.

The manned space station is years ahead yet—but it will come.

When it does, it will enable monster rockets to be built on Earth, ferried up to the space station area in sections, and there assembled.

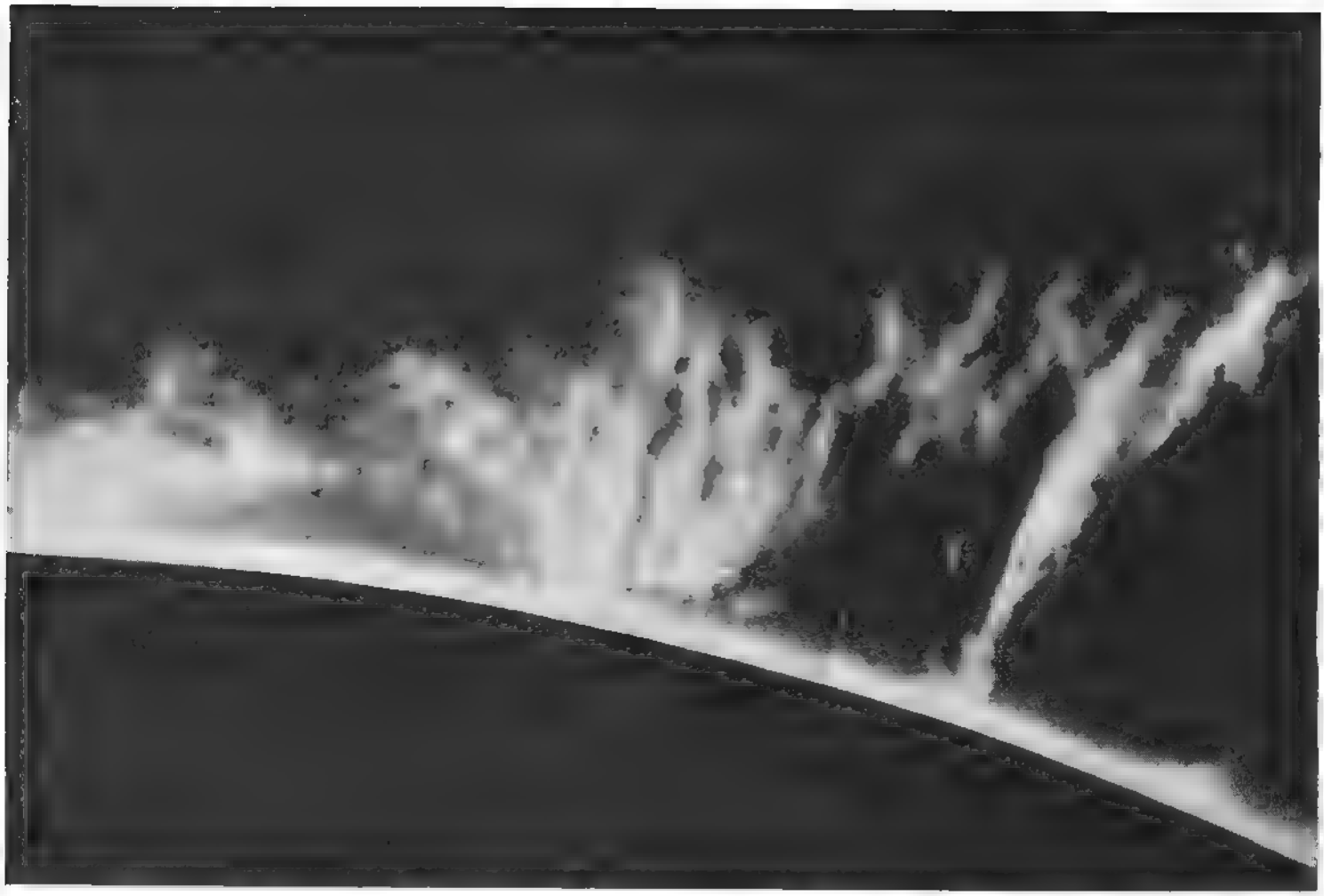
The Russians make no secret of the fact that they regard a manned space-station orbiting the Earth as more important, as a jumping-off spot for deep-space rocket trips, than the Moon itself.

A leading Soviet scientist, Professor G. V. Petrovich, explains the reason in an article he wrote for an official Soviet space journal.

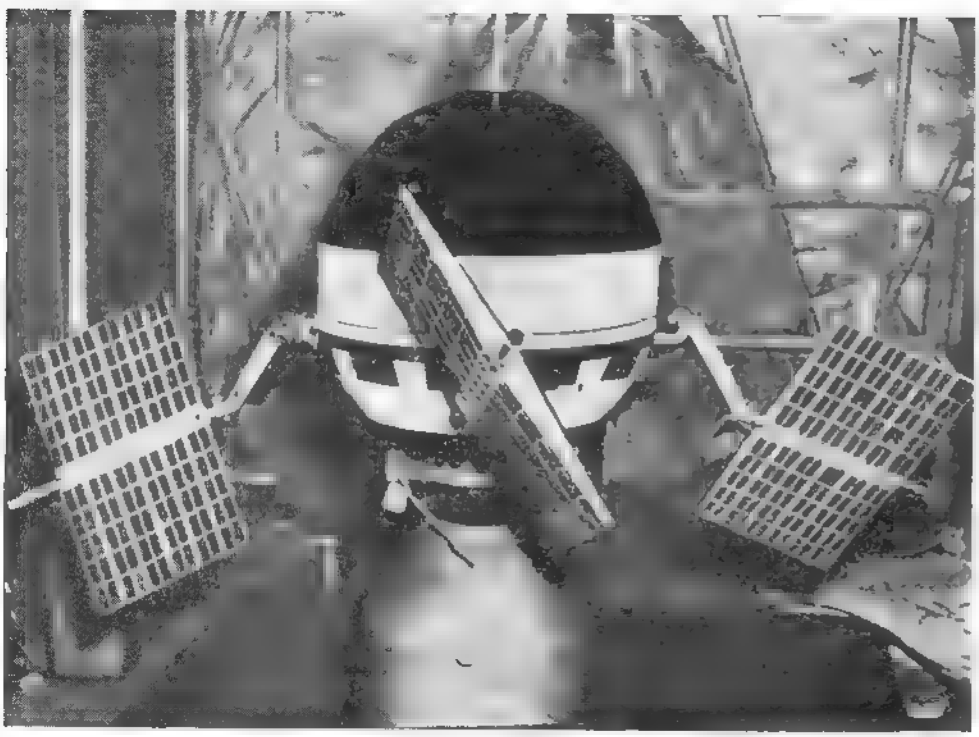
"The idea has been mooted," he says, "of using the Moon as a stepping-stone for interplanetary flight. This is illusory."

It would take too much rocket-power to set up the Moon-station, and to ferry passengers up there, he adds.

And he goes on: "Such expenditures of power could be avoided if an interplanetary station were established as an artificial satellite of the Earth."



AROUND THE SUN



TO THE NINE natural planets that have circled the Sun since the dawn of Time, man has now added four more.

All were sent into orbit during a two-and-a-half year period of the four-year-old Space Age, which dawned on October 4th, 1957.

Two are Russian, two American. As in so many other aspects of the space research project, the Russians were the trail-blazers.

The Western world was still feeling the aftermath of the New Year hangover when, on January 2nd, 1959, Moscow Radio went on the air with news of another Russian space triumph.

Soviet scientists had launched a rocket (on opposite page) weighing 1¾ tons. They sent it on a course that took it within 4,600 miles of the Moon. Then it passed the Moon and went on to become the first man-made planet of the Sun.

It now goes round the Sun once every 443 days, travelling on a track that takes it as near as 91,000,000 miles and as far from the Sun as 120,000,000 miles.

And it will carry out this stately merry-go-round for ever.

The Americans were not long in replying to this Russian feat.

Almost on the heels of Russia's artificial Sun-planet — on March 3rd — United States scientists blasted a Pioneer IV satellite away from Cape Canaveral.

The bullet-shaped, gold-plated box of electronic tricks passed within 37,300 miles of the Moon, then went on to orbit the Sun.

One round trip takes 407 days, and, like the Russian satellite it is chasing but will never catch, it will go on for ever.

The next success in the round-the-Sun race went to the Americans, too. On March 11th, 1960, a 95 lb. Pioneer V satellite (pictured opposite), the size of a beach-ball, roared away from the Cape Canaveral launch-pad, in the nose of a Thor-Able rocket.

Britain had a hand in this space triumph. A command signal, sent out by the giant radio telescope at Jodrell Bank, near Manchester, separated the beachball satellite from the final stage of the rocket, and set it on the round-the-Sun-course.

Pioneer V takes 311.6 days to go once round the Sun. The path it follows takes it to within 75,000,000 miles of the Sun. At the farthest point, it is 92,300,000 miles away.

Pioneer V set up a new record in long-distance communications. It had two radio " voices " aboard, the more powerful one relying on 28 flashlamp-sized batteries.

Jodrell Bank—the Americans were paying £50 an hour for its use—picked up messages from Pioneer V's deeper voice when the round-the-Sun probe was 22,500,000 miles from Earth.

And it is hoped that Pioneer V will be back on the air again, with more scientific chit-chat, in the early days of 1966.

The four paddlewheels fitted to the beachball-sized satellite are studded with 8,000 solar cells.

The cells convert sunlight into electricity to power the radio transmitters, and to charge up the batteries for the next lot of messages from space.

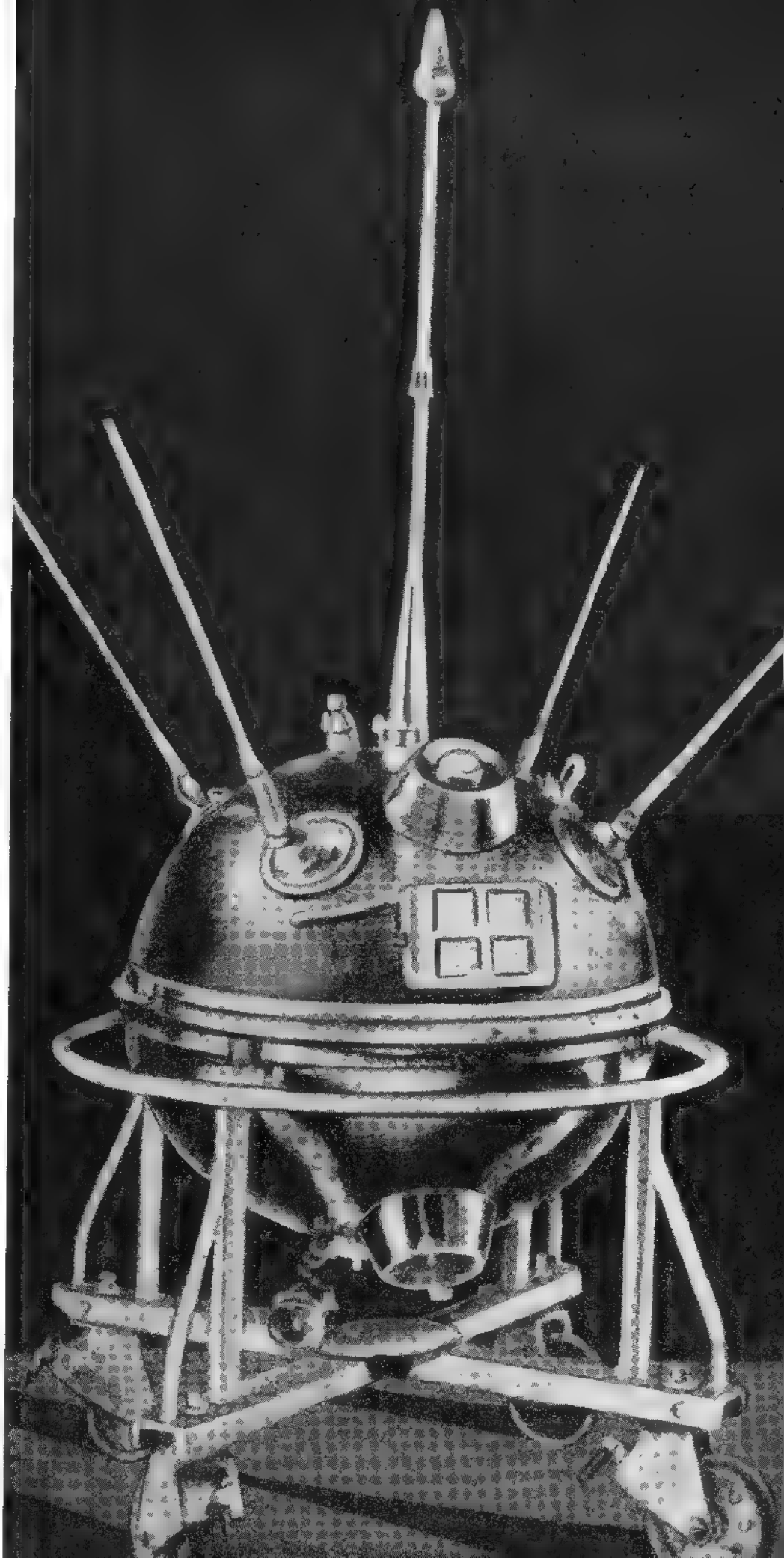
These messages reach the Earth in a kind of scientific code. It sounds like a " woo-woo " signal of varying length and intensity.

Pioneer V is sending back information all the time, but, unfortunately, it is out of reception range for most of the round-the-Sun voyage.

But if the instruments aboard have survived the ceaseless bombardment of space-radiation, and if the satellite itself has not been on the losing end of an argument with a chunk of space-dust, scientists will be tuning in, four years from now, hoping to pick up, once more, the old " woo-woo " from space.

The Russians' second Sun-orbiter is the robot observatory, launched from an orbiting Sputnik, and aimed at Venus. It left the Earth on February 12th, 1961.

The 1,419-lb. rocket passed within 62,500 miles of Venus on May 19 20th, but, unfortunately, it lost its " voice " on February 27th.



THE VENUS PROBE

VENUS IS THE loveliest of the planets. Her diameter, 7,700 miles, makes her virtually the Earth's twin.

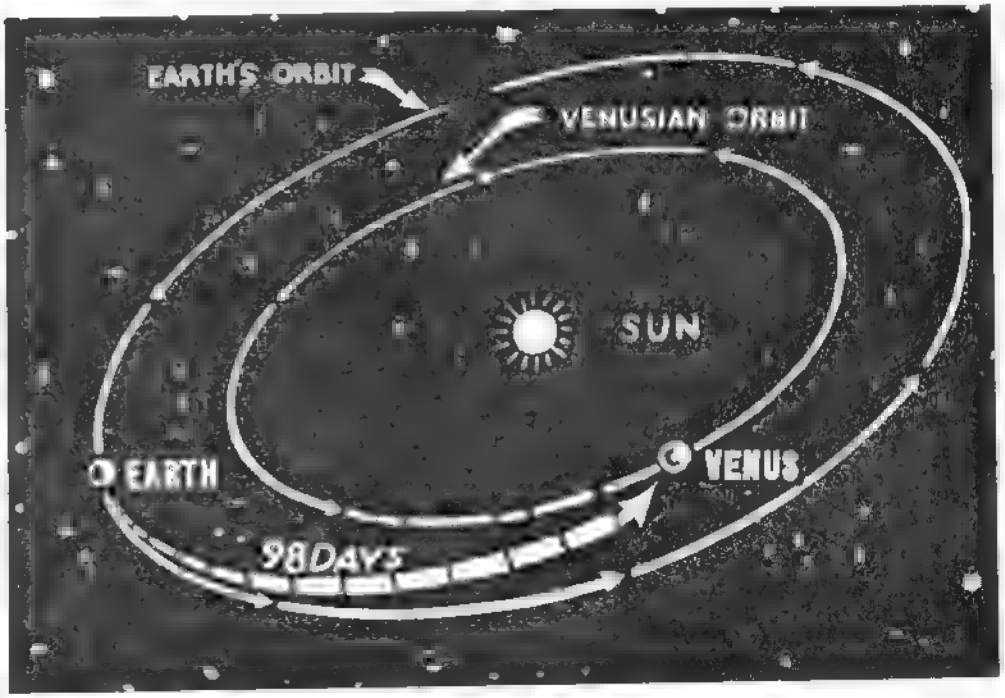
But Venus is the Mystery Planet. Little is known about conditions there, for the face of Venus is permanently veiled by dense cloud.

What lies beneath? Continuous seas? Jagged mountains? No one knows. Almost certainly there is water there, and the surface of Venus is almost certainly hot—very hot.

Scientists think that, if only they could lift the Venusian veil and peer through the dense cloud, they could discover vital clues about the origins of the Earth itself.

In February 1961, the veil was within an ace of being torn away. Then, Soviet scientists hurled a 6½-ton Sputnik into orbit round the Earth. The rocket used to launch the Sputnik is believed to be 250 ft. high (see diagram on left).

From the Sputnik while in orbit, they sent a 13-cwt. robot observatory, seen on the opposite page, on a path that would take it within a few thousand miles of Venus, so that instruments aboard the observatory could make scientific measurements.



All went well—at first. But on February 27th, the space-robot (pictured above) lost its "voice." The Venus [illegible] was dead on c[illegible]

[illegible] in charge [illegible] the giant Sputn[illegible] ting radio "eye" at Jodrell Bank, tried

The rocket is believed to have passed within 62,000 miles of the Mystery Planet during May 19th and 20th, 1961.

But if the instruments on board succeeded in making scientific measurements —and in all probability they did—they could not get the answers back to Earth.

In mid-August, 1962, conditions will be favourable for another attempt to pierce the Venusian veil. Both the [illegible] the Earth', twin in their rocket sights at that time.

America's entry is a robot space-ship called Mariner. Two models are being developed, the larger weighing half a ton. But in 1967, the Americans plan to blast a one-ton robot, called Voyager, to Venus, in an attempt to dump a 700-lb. instrument package on it.

MARS

The American plan

MARS NEXT !

The Russians make no secret of the fact that their eyes are fixed firmly on the Red Planet.

British scientists expect them to blast off for Mars in the Autumn of 1962. The precise date? Only the Russians know. They won't tell. But look for Mars in the headlines a month either side of November 16th.

The Americans, too, will take a crack at the Red Planet at about the same time.

Two rockets may well be racing through space next Autumn with Mars as the bullseye.

Are there really canals there? Do Martians exist? Could a robot rocket returning to Earth from Mars, bring back deadly germs? Does Mars provide conditions for the development of our kind of life?

Scientists on both sides of the Iron Curtain ask these questions. The answers WILL be found. Perhaps in 1962.

Mars comes within 35,000,000 miles of the Earth. It is about half the diameter of the Earth—4,200 miles compared with 7,900. The Martian day is about the same length as that of the Earth, but Mars takes nearly twice as long as the Earth to go round the Sun.

Three years ago, the Russians announced their plan for the robot conquest of Mars. This was the L-V-M Plan. The initials stand for Luna-Venus-Mars.

The man who outlined the scheme was Professor Yuri Khlebtsevich, Chairman of the Soviet Technical Committee on Radio-Television Guidance of Rockets.

The plan called for a crash-landing on the Moon, then an unmanned rocket flight to Venus, finally a robot mission to Mars. Western scientists scoffed at the L-V-M plan when it was announced.

But the Russians acted on it.

1. They crash-landed a rocket on the Moon in September 1959.

2. They threw in a bonus by sending a rocket round the Moon and photographing the far side—in October 1959.

3. They sent a robot observatory to Venus to probe the secrets of the Mystery Planet—in February 1961.

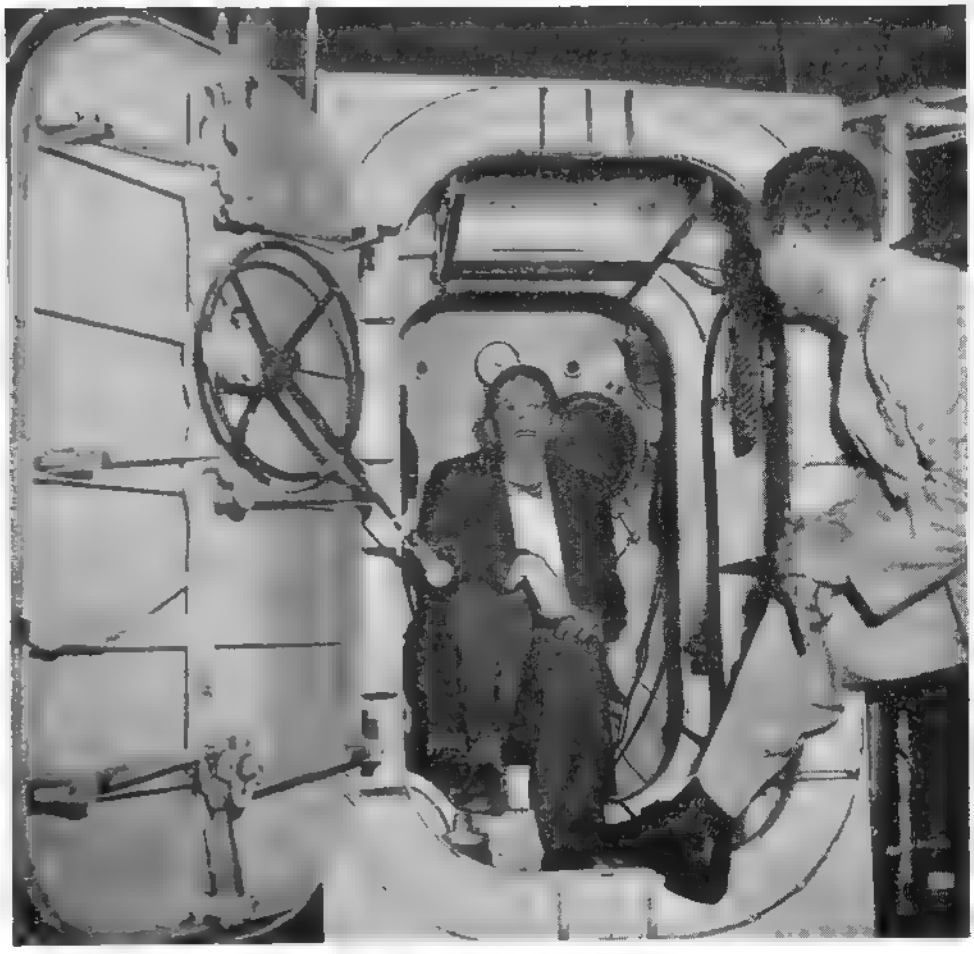
Nobody laughs now when the Russians mention Mars.

Perhaps the most thrilling mystery that may be cleared up in 1962, when Mars lines up in the Rocketmen's sights, is the theory put forward by a Soviet scientist Dr. L. Shklovsky.

He says that the two moons of Mars, Phobos and Deimos, might be giant artificial satellites launched into orbit round the Red Planet by intelligent beings who lived on Mars 2,000 to 3,000 million years ago.

Mars, the Moon, or an Earth orbit, it won't matter. When men ride into space, they have to endure the strain of blast-off and re-entry. These pictures show how three United States astronauts (top, Leroy Cooper, centre, Walter Schirra, bottom, Malcolm Carpenter), reacted to the stress.

FIRST HAND REPORT FROM A SPACE CABIN



● Space Reporter Bedford in U.S. space-cabin

WILL THE MINDS of spacemen falter, then crack, under the strain of the " all-alone " feeling they are bound to get when they leave the Earth behind for weeks at a time?

United States space-doctors know that they must find the answer to this problem before the first men are sent on a long space-trip.

They are getting the answers, thanks to a series of unique space-cabins. In these, volunteers spend days, even weeks, cut off from the entire world—without ever leaving the ground.

Life for the space-cabin volunteer is no picnic. I found this out when I was locked up in one for a short period. The cabin was 5 ft. high and 3 ft. in diameter. I could not stretch my arms out to the full extent, and could get no more exercise than a half knees-bend.

During my stay inside, the scientists in charge of the experiment deliberately :

Fused all the lights ;

Started a small fire in the cabin ;

Cut off my only means of communication—a two-way radio link—while I was receiving a report about the welfare of my family.

All this was done to see whether I would panic. I did not. I was not in the cabin long enough for panic to set in. But it could have done had I done what others did.

1. Airman Donald Farrell, 23, a six-footer, spent a week inside the same cabin.

2. Two United States Air Force pilots spent 17 days in one, and got on each other's nerves towards the end.

3. Two other Air Force officers set up a record by spending THIRTY DAYS cooped up in a cabin the size of a couple of phone boxes. Thirty days, mind-doctors reckon, is about the limit men can stand under such conditions without starting to fight each other.

Throughout the tests, the volunteers are under constant medical and psychiatric supervision. They cannot see outside their cabins—but the doctors can see in. At the first sign of mental or physical crackup likely to be serious, the tests are ended.

Equipment aboard the space-cabins provides the volunteers with all they need. But the air supply is limited—what they breathe has to be purified and re-cycled. So, too, does the water they use. I have had to drink a glass of my own urine. It looked like water, and, according to laboratory tests, tasted like water.

But the tests so far have shown one important thing : the most thorough screening will be necessary to decide who goes on a long space-trip.

Some men began to experience hallucinations after relatively short periods in space. After 36 hours, one man shouted out over his two-way radio link : " This damn TV set is turning brown. I didn't volunteer to sit in front of a tube that turns black in a matter of seconds, and gets as hot as hell." There was nothing wrong with the tube.

A second man saw wooden-headed imps peering at him through the window. And a third complained that the instruments on the control panel were slowly melting into a pool on the floor . . .

Clearly, men who get hallucinations could not be let loose in space.

Exhaustive tests in cabins like these will be carried out on all the men short-listed for space-flights.

YOUR SPACE LOG

PERFECT! America's Explorer VII, in the nose of the 60-ton U.S. Army Juno II rocket, roars away from the Cape Canaveral launch-pad

SPACE LOG

DATE	COUNTRY	NAME	PAYLOAD	MISSION	REMARKS
1957					
Oct. 4th	U.S.S.R.	SPUTNIK I	184 lb.	Earth Orbit	Orbit achieved—down early January, 1958
Nov. 3rd	U.S.S.R.	SPUTNIK II	1,120 lb.	Earth Orbit—with dog Laika	Lifetime 5½ months
Dec. 6th	U.S.A.	VANGUARD TEST VEHICLE	3½ lb.	Earth Orbit	Blew up on pad
1958					
Jan. 31st	U.S.A.	EXPLORER I	31 lb.	Earth Orbit	Orbit achieved—still in orbit but not transmitting
Feb. 5th	U.S.A.	VANGUARD TEST VEHICLE	3½ lb.	Earth Orbit	Failed after 57 seconds
Mar. 5th	U.S.A.	EXPLORER II	31½ lb.	Earth Orbit	Failed after 823 seconds flight time
Mar. 17th	U.S.A.	VANGUARD I	3½ lb.	Earth Orbit	Successful—estimated lifetime of 200 years
Mar. 26th	U.S.A.	EXPLORER III	31 lb.	Earth Orbit	Successful—down June 27th, 1958
Apl. 28th	U.S.A.	VANGUARD	21½ lb.	Earth Orbit	Failed
May 15th	U.S.S.R.	SPUTNIK III	2,925 lb.	Earth Orbit	Circled Earth 10,037 times—down April 6th, 1960
May 27th	U.S.A.	VANGUARD	21½ lb.	Earth Orbit	Failed after 20 minutes' flight
June 26th	U.S.A.	VANGUARD	21½ lb.	Earth Orbit	Failed
July 26th	U.S.A.	EXPLORER IV	38½ lb.	Earth Orbit	Successful—down October 23rd, 1959
Aug. 17th	U.S.A.	LUNAR PROBE	84 lb.	Rehearsal for survey of Moon	Failed after 77 seconds—reached 50,000 feet
Aug. 24th	U.S.A.	EXPLORER V	38½ lb.	Earth Orbit	Failed after 659 seconds
Sept. 26th	U.S.A.	VANGUARD	21½ lb.	Earth Orbit to study cloud cover	Failed
Oct. 11th	U.S.A.	PIONEER I	84½ lb.	Deep Space Probe	Went 79,300 miles
Oct. 23rd	U.S.A.	BEACON	18 lb.	Put 12-ft. dia. plastic balloon into space	Failed after 424 seconds
Nov. 8th	U.S.A.	PIONEER II	87 lb.	Moon probe	Failed after 42 minutes
Dec. 6th	U.S.A.	PIONEER III	13 lb.	Deep Space Probe	Went 66,000 miles
Dec. 18th	U.S.A.	SCORE	8,750 lb.	Space Communication	Successful. Relayed message from Eisenhower to world via Space
1959					
Jan. 2nd	U.S.S.R.	LUNIK I	3,245 lb.	Deep Space Study	Orbiting of Sun, after passing within 4,600 miles of the Moon
Feb. 17th	U.S.A.	VANGUARD II	21½ lb.	Earth Orbit for cloud study	Successful—lifetime 10 years or more
Feb. 28th	U.S.A.	DISCOVERER I	1,300 lb.	Place satellite in near-Polar Orbit	Lifetime 10 days
Mar. 3rd	U.S.A.	PIONEER IV	13½ lb.	Deep Space Probe	Orbiting Sun every 407 days
Apl. 13th	U.S.A.	DISCOVERER II	1,600 lb.	Near-Polar Orbit	Lasted 13 days
Apl. 13th	U.S.A.	VANGUARD	23½ lb.	Earth Orbit to map magnetic field, and launch two satellites	Failed
June 3rd	U.S.A.	DISCOVERER III	1,600 lb.	Rehearsal of attempt to recover capsule from orbit—four black mice aboard	Experiment failed
June 22nd	U.S.A.	VANGUARD	22½ lb.	Earth Orbit of weather satellite	Failed
June 25th	U.S.A.	DISCOVERER IV	1,700 lb.	Attempt to recover 300-lb. capsule by catching it in mid-air	Experiment failed
July 16th	U.S.A.	JUNO II	91½ lb.	Earth Orbit	Destroyed by safety officer after 5 seconds
Aug. 7th	U.S.A.	EXPLORER VI	142 lb.	Study space radiation around Earth with paddle-wheel satellite	Launched successfully—Still in orbit
Aug. 13th	U.S.A.	DISCOVERER V	1,700 lb.	Attempt to recover 300-lb. capsule from orbit	Orbit achieved. Capsule ejected but lost
Aug. 14th	U.S.A.	BEACON II	84 lb.	Place 12-ft. dia. balloon in orbit	Failed
Aug. 19th	U.S.A.	DISCOVERER VI	1,700 lb.	Polar Orbit. Capsule recovery attempt	Orbit achieved, capsule separated but not recovered
Sept. 12th	U.S.S.R.	LUNIK II	858 lb.	Land on Moon	Landed just after 10 p.m., Sept. 13th, near the Sea of Serenity—about 600 miles off centre of Moon
Sept. 17th	U.S.A.	TRANSIT I-A	265 lb.	Test of navigational satellite	Failed
Sept. 18th	U.S.A.	VANGUARD III	100 lb.	Study magnetic field, solar x-rays	Successful—lifetime 30–40 years
Oct. 4th	U.S.S.R.	LUNIK III	4,037 lb.	Circumnavigate the Moon and photograph the far side	Successful—first pictures of the far side of Moon—published 3 weeks later
Oct 13th	U.S.A.	EXPLORER VII	91½ lb.	Earth Orbit for radiation experiment	Successful—lifetime 20–30 years
Nov. 7th	U.S.A.	DISCOVERER VII	1,700 lb.	Attempt to recover 300-lb. capsule	Orbit achieved but electrical malfunction prevented separation of capsule. Failed
Nov. 20th	U.S.A.	DISCOVERER VIII	1,700 lb.	Attempt to recover 300-lb. capsule	Orbit achieved—capsule ejected but could not be located
Nov. 26th	U.S.A.	PIONEER	372 lb.	Moon Probe—Circumnavigate and photograph	Failed after 70 seconds
1960					
Feb. 4th	U.S.A.	DISCOVERER IX	1,700 lb.	Attempt to recover 300-lb. capsule	Failed.
Feb. 19th	U.S.A.	DISCOVERER X	1,700 lb.	Attempt to recover 300-lb. capsule	Vehicle destroyed by safety officer
Feb. 26th	U.S.A.	MIDAS I	4,500 lb.	Test of missile-detection satellite	No orbit
Mar. 11th	U.S.A.	PIONEER V	95 lb.	Deep Space Probe and test of communications at extreme ranges	Successful—went into Sun orbit between Earth and Venus—made communications with Jodrell Bank to distance of 22½ million miles
Mar. 23rd	U.S.A.	EXPLORER	35 lb.	Radiation study	Orbit not achieved
Apl. 1st	U.S.A.	TIROS I	270 lb.	Weather satellite launched into circular orbit	Sent back 22,000 pictures of cloud cover—lifetime of 50–100 years
Apl. 13th	U.S.A.	TRANSIT I-B	265 lb.	Navigational satellite	Orbit achieved—lifetime 16 months
Apl. 15th	U.S.A.	DISCOVERER XI	1,700 lb.	Recovery of 300-lb. capsule	Polar Orbit achieved. Capsule ejected but lost
May 13th	U.S.A.	ECHO	132 lb.	Put 100-ft. dia. balloon into orbit	Failed
May 15th	U.S.S.R.	SPACE-SHIP I	4½ tons	Test life support systems for manned space flight—dummy man aboard	Test successful—lifetime brief
May 24th	U.S.A.	MIDAS II	5,000 lb.	Missile detection satellite	Orbit achieved—lifetime 40 months but transmission failure after two days
June 22nd	U.S.A.	TRANSIT II-A	265 lb.	Navigational satellites test	Electronic clock put into orbit—two satellites launched each with a lifetime of 50 years. Still transmitting
June 29th	U.S.A.	DISCOVERER XII	1,700 lb.	Recovery of 300-lb. capsule	Failed to orbit
Aug. 10th	U.S.A.	DISCOVERER XIII	1,700 lb.	Recovery of 300-lb. capsule	Capsule ejected—recovery successful over sea near Hawaii
Aug. 12th	U.S.A.	ECHO I	240 lb.	Put 100-ft. dia. balloon satellite in orbit	Orbit achieved—balloon used in communications' experiment to bounce messages right across U.S.A.
Aug. 18th	U.S.A.	DISCOVERER XIV	1,700 lb.	Recovery of 300-lb. capsule	Orbit achieved. Capsule ejected and caught 8,000 ft. in mid-air in a "butterfly" net of C-119 aircraft
Aug. 18th	U.S.A.	COURIER I-A	500 lb.	Test of space communications system	Rocket exploded after 2½ minutes

LAUNCHINGS

DATE	COUNTRY	NAME	PAYLOAD	MISSION	REMARKS
1960					
Aug. 19th	U.S.S.R.	SPACE-SHIP II	4½ tons	Place space-ship into Earth orbit and recover	Two dogs, Strelka and Belka, with rats, mice, flies and seeds. Returned to Earth after 25 hours in space
Sept. 13th	U.S.A.	DISCOVERER XV	1,700 lb.	Recovery of 300-lb. capsule	Orbit achieved—capsule ejected and landed in sea—sighted but lost due to rough sea
Sept. 25th	U.S.A.	PIONEER	387 lb.	Study of space between Earth and Moon	Failed
Oct. 4th	U.S.A.	COURIER I-B	500 lb.	Communications satellite	Orbit successful—satellite transmitting 68 thousand words per minute
Oct. 11th	U.S.A.	SAMOS I	not available	Satellite and missile observation	Failed
Oct. 26th	U.S.A.	DISCOVERER XVI	2,100 lb.	Recovery of 300-lb. capsule	Orbit not achieved
Nov. 3rd	U.S.A.	EXPLORER VIII	90 lb.	Radiation study	Orbit achieved—lifetime estimated 10 years or more
Nov. 12th	U.S.A.	DISCOVERER XVII	2,100 lb.	Recovery of 300-lb. capsule	Orbit achieved—capsule ejected and caught near Hawaii in mid-air
Nov. 23rd	U.S.A.	TIROS II	280 lb.	Weather satellite	Orbit achieved—lifetime estimated 50–100 years
Nov. 30th	U.S.A.	TRANSIT III-A	243 lb.	Navigational satellite	Two satellites launched but these were destroyed shortly after takeoff
Dec. 1st	U.S.S.R.	SPACE-SHIP III	4½ tons	Rehearsal for man in space flight	Two dogs and other animals aboard. Space-ship circled the Earth for two days. When ordered to return a fault developed and ship destroyed in dense atmosphere
Dec. 4th	U.S.A.	EXPLORER	87 lb.	Launch small balloon into space	Second stage failed to ignite
Dec. 7th	U.S.A.	DISCOVERER XVIII	2,100 lb.	Recovery of 300-lb. capsule	Orbit achieved—capsule successfully caught in mid-air after making 48 orbits
Dec. 15th	U.S.A.	PIONEER	388 lb.	Study of space between Earth and Moon	Explosion destroyed vehicle for Moon probe after 70 seconds' flight
Dec. 20th	U.S.A.	DISCOVERER XIX	2,100 lb.	Study of infra-red radiation in atmosphere	Orbit achieved—lifetime 40 days
1961					
Jan. 31st	U.S.A.	SAMOS II	4,100 lb.	Observation of Earth from space	Orbit achieved
Jan. 31st	U.S.A.	MERCURY-REDSTONE	1 ton	To take Ham—a chimpanzee—on a 15-minute space trip	Successful—Ham went 155 miles up and 420 miles out
Feb. 4th	U.S.S.R.	SPUTNIK IV	7 tons	Rehearsal for Venus probe	Orbit achieved—Sputnik down on February 26th
Feb. 12th	U.S.S.R.	SPUTNIK V	6½ tons	Launch probe towards area of Venus	First launch from orbiting Sputnik
Feb. 16th	U.S.A.	EXPLORER IX	80 lb.	Place small balloon satellite in Earth orbit	Balloon launched but transmitter failed
Feb. 17th	U.S.A.	DISCOVERER XX	2,450 lb.	Recovery of 300-lb. capsule	Orbit achieved—lifetime 6 months. Recovery not attempted because of equipment failure
Feb. 18th	U.S.A.	DISCOVERER XXI	not available	Test of satellite warning equipment	Orbit achieved—2nd stage rocket engine stopped and started in space
Feb. 21st	U.S.A.	TRANSIT III-B	307 lb.	Launch two satellites for test of navigational aids	Orbit achieved but satellites failed to separate
Feb. 24th	U.S.A.	EXPLORER	74 lb.	Ionosphere study	Failed
Mar. 9th	U.S.S.R.	SPACE-SHIP IV	4½ tons	Further rehearsal for man-in-space flight	Dog aboard, with guinea pigs, black mice, insects and seeds. Orbit achieved—recovery successful—all animals alive
Mar. 25th	U.S.S.R.	SPACE-SHIP V (VOSTOK)	4½ tons	One dog and other animals aboard	Orbit achieved—recovery successful
Mar. 25th	U.S.A.	EXPLORER X	79 lb.	Study interplanetary magnetic field	Satellite transmitted continuously for 60 hours
Mar. 30th	U.S.A.	DISCOVERER XXII	2,100 lb.	Study of space radiation on biological specimens	Orbit not achieved
Apl. 8th	U.S.A.	DISCOVERER XXIII	2,100 lb.	Recovery of 300-lb. capsule	Orbit achieved—capsule ejected but not recovered
Apl. 12th	U.S.S.R.	SPACE-SHIP VI (VOSTOK)	4½ tons	First manned orbital flight (Major Yuri Gagarin)	Flight took 108 minutes of which 89 minutes were spent in orbit
Apl. 25th	U.S.A.	MERCURY-ATLAS III	2,000 lb.	Attempt to place space-ship with a dummy man aboard into orbit and to recover	Destroyed immediately after lift-off
Apl. 27th	U.S.A.	EXPLORER XI	82 lb.	Orbit radiation telescope	Orbit achieved—lifetime 1–3 years. Systems functioning well
May 5th	U.S.A.	MERCURY-REDSTONE	1 ton	Launch Astronaut Commander Alan Shepard on sub-orbital flight	Successful. "Freedom Seven" space craft went 115 miles up and 302 miles down-range from launching site
May 24th	U.S.A.	EXPLORER	75 lb.	Ionospheric radiation study	Orbit not achieved
June 8th	U.S.A.	DISCOVERER XXIV	2,100 lb.	Recovery of 300-lb. capsule	Failed
June 16th	U.S.A.	DISCOVERER XXV	2,100 lb.	Recovery of 300-lb. capsule	Orbit achieved—capsule ejected and recovered north of Hawaii
June 29th	U.S.A.	TRANSIT IV-A	270 lb.	Orbit three satellites	Orbits achieved—two satellites failed to separate. One of the satellites had an atomic power unit aboard
June 30th	U.S.A.	EXPLORER	187 lb.	Study of micrometeorites	Third stage failed to ignite
July 7th	U.S.A.	DISCOVERER XXVI	2,100 lb.	Recovery of 300-lb. capsule	Orbit achieved—capsule recovered in mid-air
July 12th	U.S.A.	TIROS III	285 lb.	Weather satellite	Orbit achieved—pictures received of Earth's cloud cover. Lifetime 3–4 months
July 12th	U.S.A.	MIDAS III	3,500 lb.	Missile detection tests	Orbit achieved
July 21st	U.S.A.	DISCOVERER XXVII	2,100 lb.	Recovery of 300-lb. capsule	Failed—rocket destroyed by range safety officer
July 21st	U.S.A.	MERCURY-REDSTONE	1 ton	Launching of Captain Virgil Grissom in sub-orbital flight	Successful—"Liberty Bell" space-ship went 118 miles up and 305 miles out from the launching point
Aug. 3rd	U.S.A.	DISCOVERER XXVIII	2,100 lb.	Recovery of 300-lb. capsule	Satellite failed to reach orbit
Aug. 6th	U.S.S.R.	SPACE-SHIP VII (VOSTOK II)	4½ tons	One day in space with Major Gherman Titov aboard	Successful—spaceman recovered after 25 hours 18 minutes in space and 17½ orbits
Aug. 15th	U.S.A.	EXPLORER XII	83 lb.	Study of solar winds	Travelling on eccentric orbit—bringing it to within 170 miles of Earth and out to 50,000 miles
Aug. 23rd	U.S.A.	RANGER I	675 lb.	First test of a lunar space-craft	Ranger placed in low Earth orbit, down Aug. 29th
Aug. 25th	U.S.A.	EXPLORER XIII	187 lb.	Study of micrometeorites in space	Orbit achieved—estimated lifetime one year
Aug. 30th	U.S.A.	DISCOVERER XXIX	2,100 lb.	Recovery of 300-lb. capsule	Successful—capsule ejected during 33rd orbit and recovered from sea
Sept. 12th	U.S.A.	DISCOVERER XXX	2,100 lb.	Recovery of 300-lb. capsule	Successful
Sept. 13th	U.S.A.	MERCURY-ATLAS	Nearly 2 tons	One orbit of the Earth with dummy man	Orbit achieved—recovered from sea near Bermuda
Sept. 17th	U.S.A.	DISCOVERER XXXI	2,100 lb.	Recovery of 300-lb. capsule	Failed

Printed in England by FLEETWAY PUBLICATIONS LTD., LONDON